

MEMOIRS
OF THE
TORREY BOTANICAL CLUB.

Vol. VI.

No. 2.

A Revision of the North American Isotheciaceae and Brachythecia.

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The work on the Isotheciaceae and Brachytheciaceae was undertaken with the purpose of correlating and bringing up to date the later work on the American plants of this group which has been done largely by foreigners and has been published in various scientific publications, some of which are difficult of access. Barnes and Heald's new Keys to the Genera and Species, it is true, contain all these collected descriptions, but it has been felt by every student of American bryology that much of the recent work, especially that of Nils Conrad Kindberg, was, to say the least, of uncertain value. The sentiments expressed by Dr. Barnes concerning this matter in the preface to the second edition of his Keys, are heartily approved by every American bryologist. A very large proportion of the new species in this group has been founded on insufficient and incomplete material and the descriptions of perfect specimens even have often been entirely inadequate for the determination of the species.

My thanks are especially due to Professor John Macoun, Dr. William Mitten and M. Jules Cardot for notes and specimens. By Professor Macoun's kindness I have been able to examine type collections of most of Kindberg's new species. Professor Macoun assures me that the specimens of *Brachythecium harpidioides*, *B. lamprochryseum*, *B. gemmascens*, *B. rutabuliforme*, *B. pseudo-collinum*, *B. nanopes*, *B. platycladum* and *B. mirabundum* "are absolutely identical with those named by Kindberg."

The work was undertaken at the suggestion of Mrs. Elizabeth G. Britton, to whose kind criticism and assistance is due much of whatever value this revision may possess. These studies were begun about the time that Limpricht's treatise on the Isotheciaceae (Rabenhorst Kryptogamen Flora) was issued and it was planned to parallel his work on the European plants of this and related groups by a somewhat similar treatment of the American forms.

Except the recent issue of the first part of Braithwaite's work on the pleurocarpous mosses, all the extended treatments of the Musci Pleurocarpi have followed Schimper's classification in principle.

A somewhat fragmentary publication like this has followed the more extended treatises in this particular by reason of the comparatively narrow limits of the work.

This study was begun with no bias either for or against Schimper's classification, but, as the work progressed, it became more and more evident that the Isotheciaceae do not form a natural group, but a highly artificial one, being based principally on the following characters: Erect capsule, inner peristome attached to a narrow basal membrane, and absence of cilia.

It is very easy to see that the cilia, being merely thickenings of cell walls, would be much more likely to disappear wholly or partially as a variation than that the variation should modify the general structure of the plant and leaf. In some plants the number of cilia varies from one perfect cilium and another imperfect to three perfect cilia. In *Brachythecium Fendleri*, which is described as having cilia solitary and short or none, other capsules from type specimens possess two well developed cilia. In species where cilia have never been known to develop, the lack of cilia is of greater import, but even when associated with an erect capsule cannot be considered as a character suitable to distinguish families, although these characters may well distinguish species or even genera, their importance depending solely on their constancy.

Any one who will take the trouble to compare carefully the European species of *Homalothecium* with several species of *Camptothecium* cannot help seeing that the two genera are much more closely related than *Homalothecium* and *Entodon*, or any genera of the Isotheciaceae.

The species of *Pylaisiella* also are so closely related to *Hypnum* (*Raphidostegium*) *cylindricarpum* Muell. that Jaeger (St. Gall. Nat. Gesell. 1876-77: 304) calls the latter a *Pylaisia*. *Hypnum cylindricarpum*, notwithstanding, is not a unique species in this respect, but is very closely related to several other species, notably *H. microcarpum* Muell. *Entodon* is also more closely allied to *Plagiothecium* than to any of the other Isotheciaceae.

All the species of *Isothecium* itself excepting, perhaps, *I. myurum* are so closely related to *Brachythecium* and other genera of the Brachytheciaceae that there is no reason whatever for putting them in another family. These conclusions were arrived at independently, but a comparison with Lindberg's *Musci Scandinavici* will show that this is essentially his idea of the relations of the species, although he combines the genera to an extent not likely to be approved by succeeding workers.

These facts have led to the conclusion that, in the Hypnaceae at least, Lindberg's general classification must be conceded to be much more natural than that of Schimper. In order to present the result of two years' labor in a form available for immediate use, the generally accepted classification has necessarily been followed in part, but care has been taken to arrange the species in genera in a way that will not require any change in order to conform to the general principles of Lindberg's classification.

A great deal of attention has been given to ascertaining the habitat and distribution of the species, as data of this kind have proved of the greatest value in deducing those general principles of biology which represent the highest achievements of science and to which the systematist, the physiologist, and the morphologist alike contribute.

In this connection it is worthy of remark that very few collectors give sufficient data on their labels. It is to be hoped that the collectors of the future will record the exact habitat of each collection and time at which the collection was made as well as locality and year. Had these data been given with each specimen studied in the preparation of this revision, the work would have been much simplified and its value greatly enhanced. The aim of the work has been to render intelligible the species already de-

scribed rather than to complicate the matter by making a new species of every doubtful specimen at hand. Doubtless a more complete knowledge of our moss-flora will show that many forms described as varieties will prove to be good species.

The keys are entirely new and have been made with special reference to their use by amateurs. Gametophyte characters have been used in preference to sporophyte characters wherever possible, in order to facilitate the identification of sterile specimens.

Special care has been taken to correlate the descriptions so that any character of two closely related species can be easily compared. Measurements, both comparative and absolute, have been given in order to facilitate such comparisons.

The absence of many published varieties will be noticed and probably criticized. The extreme multiplication of varieties, so much in vogue with the Germans, seems to the author to be confusing and valueless. Only well marked varieties, with characters easily recognizable, have been included. Often these would seem to be good species except for the many intermediate forms. In other cases more material will probably give characters sufficient to raise the varieties to specific rank.

ISOTHECIACEAE Spruce, Ann. and Mag. Nat. Hist. (II.) 3: 285. 1849.

Gametophyte generally large, never minute. Primary stems creeping, radiculose. Paraphyllia lacking (except in *Climacium*). Leaves smooth, often plicate or concave; median leaf-cells linear, alar cells quadrate (except in *Holmgrenia*). *Sporophyte* long exerted. Seta smooth, twisted. Calyptra cucullate. Operculum conic to conic-rostrate. Columella persistent. Capsule erect, straight, not conspicuously contracted under the mouth when dry. Peristome double, well developed; teeth lanceolate, articulate. Segments of endostome linear to lanceolate, attached to a narrow basal membrane, free, or adherent to the teeth in two species of *Pylaisiella*; cilia rudimentary or wanting. Spores roughened.

Distinguished from the Brachytheciaceae by the straight erect capsule not contracted under the mouth when dry, absence of cilia and short basal membrane.

Homalothecium and certain species of *Brachythecium* (notably *B. acuminatum*) have the capsule characters of this family, but their other characters show their relationship to be with the Brachytheciaceae.

Key to the Genera.

- Leaves costate, costa single, extending to the middle of the leaf or beyond. 4. CLIMACIUM.
- Leaves ecostate or the costa short and double. 3. HOLMGRENIA.
- Alar cells not quadrate.
- Alar cells quadrate.
 - Leaves complanate (except *E. repens* and *E. seductrix*); annulus large, persistent (except *E. Drummondii*). 1. ENTODON.
 - Leaves more or less falcate-secund especially at the tips of branches; annulus narrow. 2. PYLAISIELLA.

1. ENTODON C. Muell. Linnaea, 18: 704. 1844. Also Bot. Zeit. 2: 740. 1844.

[CYLINDROTHECIUM Br. & Sch. Bryol. Eur. fasc. 46, 47. pl. 464, 465. 1851.]

Gametophyte growing in wide intricate mats. Stems densely leafy, creeping, subpinnately branching (stems erect and pinnate in *E. orthocarpus*); stem and branches more or less complanate-

foliate, not radiculose above, without paraphyllia. Leaves pluri-seriate, imbricate, entire or slightly serrate at apex, smooth, concave, ecostate or with a very short double costa; leaf-cells linear, enlarged and quadrate at the basal angles. Male branches gemmiform, borne on the stem. *Sporophyte* with the seta long, smooth, twisted to the right. Calyptra cucullate. Capsule cylindric, erect and symmetric or sometimes slightly curved. Operculum conic to conic-rostrate. Columella persistent. Annulus large and conspicuous (aborted and indistinct in *E. Drummondii*), remaining attached after dehiscence and falling away in fragments with age. Peristome double, inserted below the mouth of the capsule; teeth subulate to linear-lanceolate, strongly articulate; segments narrowly linear, carinate, attached to a very narrow basal membrane (usually free in *E. repens*; attached to teeth as a hyaline margin in *E. brevisetum*). Spores brown to brownish green, minutely roughened.

The leaves of many species of this genus are much more variable than the peristome, consequently the distinctions are based upon peristome characters wherever possible.

Leaves obtuse; quadrate alar cells in 2 or 3 layers.

7. *E. orthocarpus*.

Leaves acute or acuminate; quadrate alar cells in one layer.

Leaves gradually narrowly acuminate; segments of endostome adhering to the teeth.

8. *E. brevisetus*.

Leaves acute to apiculate; segments free.

Teeth conspicuously hyaline margined.

6. *E. repens*.

Teeth not conspicuously hyaline margined.

Annulus apparently none; seta yellow.

5. *E. Drummondii*.

Annulus narrow, of small cells; seta red.

2. *E. seductrix*.

Annulus large, of large cells.

Teeth uniformly papillose-roughened.

3. *E. compressus*.

Teeth conspicuously striolate above; leaves serrate.

4. *E. Sullivantii*.

Teeth not conspicuously striolate; leaves nearly entire.

1. *E. cladorrhizans*.

1. ENTODON CLADORRHIZANS (Hedw.) C. Muell. Linnaea, 18: 707. 1844. Also Bot. Zeit. 1844.

Neckera cladorrhizans Hedw. Sp. Musc. 207. pl. 47. 1801.

Cylindrothecium cladorrhizans Schimp. Syn. Ed. 1, 514. 1860.

Entodon Transylvanicus Demet. Hedwigia, 23: 81. 1884.

Entodon minutipes Kindb. Can. Rec. Sci. 1894: 21. 1894.

Gametophyte in wide soft glossy yellowish-green intricate mats ; stems about 5 cm. long, subpinnately branching ; stems and short branches complanate-foliate, lying in the same plane ; older branches often radiculose at end ; branch leaves oblong-ovate, 1.5 by 0.6–0.8 mm., acute, entire or slightly denticulate at apex, very concave ; costa short and double ; median cells linear fusiform, 10–15 : 1 ; quadrate alar cells numerous ; stem leaves larger and broader at base : monoicous ; male branches frequent ; antheridia few, large, cylindric ; perigonial leaves sub-orbicular to oval, short acuminate, entire, ecostate : perichaetium 2.5 mm. long, loosely sheathing ; the inner leaves oblong-acuminate, denticulate at extreme apex ; upper cells linear ; basal enlarged, hyaline, rhomboidal to rectangular. *Sporophyte* 1.5 to 2.5 cm. high ; seta light reddish brown ; capsule cylindric-ovoid, brown, 3.5 mm. long, 5–6 : 1 ; annulus large, of two rows of cells ; peristome about .35–.4 mm. long ; teeth linear-lanceolate, reddish brown, closely and regularly articulate and slightly granulose-roughened below, lighter, more distantly articulate and smooth or finely striolate above, with conspicuous median line, often perforate between articulations ; segments linear, as long as the teeth ; spores minutely roughened, 16μ , maturing in autumn.

Type locality, Lancaster, Pa. (Muhlenberg).

On roots of trees, old logs, soil, etc. Not uncommon in North America east of the Mississippi ; Minnesota (Holzinger) ; Iowa (A. S. Hitchcock and Miss McGee).

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 91 ; Hedw. l. c. ; A. Gray, Man. Ed. 2, *pl.* 5 ; Lesq. & James, Mosses of N. A. *pl.* 5 ; Husnot, Musc. Gall. *pl.* 89 ; Rab. Krypt. Fl. 4³ : *f.* 356.

EXSICCATI.—Drumm. Musc. Am. (S. States) 96, (*Neckera cladorrhizans*) ; Sull. Musc. Allegh. 77 ; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 260, (Ed. 2) 386. Macoun, Can. Musc. 263.

Limpricht, in Rab. Krypt. Fl. 4 : part 3 : 30, separates *E. Schleicheri* of Europe from *E. cladorrhizans* and also cites *E. cladorrhizans* as European. That the two species are distinct can hardly be doubted, if the teeth of the peristome be compared. *E. acicularis* C. Muell. and Kindb. in Macoun, Cat. Can. Pl. part 6, 176 (Macoun's 816 in part and 170), is only a peculiar form of *E. cladorrhizans*. It may possibly prove to be a good variety.

It is characterized by having a peculiar brownish green color, the tips of branches lighter; very short turgid branches which are largest in the middle and at the largest part bear leaves as large as the stem leaves; capsule and seta much shorter and teeth more perforate than is typical. *E. Transylvanicus* Demeter and *E. minutipes* Kindb. are said by Limpricht, l. c. to be identical, and only slightly divergent forms of *E. cladorrhizans*. I have been unable to see specimens of either.

2. ENTODON SEDUCTRIX (Hedw.) C. Muell. Linnaea, 19: 214.
1847.

Neckera seductrix Hedw. Sp. Musc. 208. pl. 47. f. 8-13.
1801.

Pterigynandrum Carolinianum Brid. Musc. Recent. Suppl. 1:
132. 1803.

Cylindrothecium seductrix Sull. in A. Gray, Man. Ed. 2, 664.
1856.

Gametophyte in wide glossy yellowish-green mats; stems about 5 cm. long, more or less complanate-foliate; branches nearly terete, 5-10 mm. long, often giving off short secondary branches; branch leaves imbricate-appressed, oblong-elliptical to ovate, about 1.2 by 0.7 mm., short-apiculate, entire or slightly denticulate above; costa short and double, median cells linear; quadrate alar cells numerous; stem leaves ovate, larger, with rather broader cells; monoicous; male branches abundant, short-stipitate; antheridia comparatively few, large, oblong; perigonial leaves obovate, apiculate, entire, bordered with a row of narrow cells, ecos-tate; paraphyses large: perichaetium about 2.5 mm. long, loosely sheathing; the inner leaves oblong-acuminate, serrulate at apex, somewhat plicate with a thin costa extending to the middle. *Sporophyte* 1.3-1.6 cm. high; capsule reddish brown, cylindric, 3-3.5 mm. long, 5-6:1; operculum conic-rostrate; annulus of two to three rows of small cells, obscured by base of teeth; teeth of peristome subulate, short, 0.3 mm. long, very deeply inserted, about $\frac{1}{5}$ below the mouth of capsule, dark reddish brown below, much lighter above, bordered by a lighter margin, with a very distinct median line throughout the entire length; articulations close and irregular below but distant above, only 7 to 10 appearing above the mouth of capsule; segments linear, about the length of

the teeth; spores about 15μ , finely roughened, time of maturing variable, probably depending on season, autumn to early winter.

Type locality, Lancaster, Penn. (Muhlenberg).

On decaying wood, earth, moist rocks, bark of trees, etc.

A very variable species and appropriately named; found only in the eastern United States and Canada. Common in the Appalachian region from Canada to the Gulf; less frequent northward and not reported far west of the Mississippi. I have seen no specimens from northern New England or eastern Canada.

Dallas, Texas (J. Boll); Missouri, Kansas, Wisconsin, Minnesota, Ontario.

ILLUSTRATIONS.—Hedw. l. c.; Sull. Icon. Musc. *pl.* 92.

EXSICCATI.—Drumm. Musc. Am. (S. States) 97, (*Neckera seductrix*); Sull. Musc. Allegh. 78; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 261, (Ed. 2) 387; Macoun, Can. Musc. 663; Ren. & Card. Musc. Am. Sept. Exsic. 90.

2a. *E. SEDUCTRIX LANCEOLATUS* Grout, Bull. Torr. Club, 23: 226.
1896.

Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering gradually to the serrate acute apex; median cells 12:1; capsule 3–5 mm. long, about 8:1.

On rotten wood, Hanging Rock, Wabash Co., Ill., April 3, 1890. (J. Schneck.)

2b. *E. SEDUCTRIX MINOR* (Aust.) Grout, l. c.

Entire plant much reduced, dirty green; leaves, seta and capsule shorter than in type. Capsules 1.5–2 mm. long, its length about 3 times its diameter.

Ohio (Sullivant); sand hill near Augusta, Ga. (J. D. Smith), Feb. 2, 1877. A portion of no. 388 of Sull. and Lesq. Musc. Bor. Am., in Columbia Herb., issued as *Cylindrothecium compressum* Br. and Sch. is this variety.

2c. *E. SEDUCTRIX DEMETRII* (Ren. & Card.) Grout, l. c.

Cylindrothecium Demetrii Ren. & Card. Rev. Bryol. 20: 14.
1893.

Stems irregularly divided and branched, strongly complanate-foliate, slender, having almost exactly the facies of *E. compressus*;

leaves ovate, gradually acute, very entire. Peristomal teeth often irregularly perforate.

On stones at top of well, Emma, Saline Co., Mo. (Rev. C. H. Demetrio).

This species is easily distinguished from *E. cladorrhizans* by its short deeply inserted sparsely articulate peristomal teeth, peculiar annulus, and by its dark and less flattened stem and branches. It is exceedingly variable and the three varieties named above are the most aberrant forms. Judging from the figures, Hedwig's type differs a good deal from the plant figured by Sullivant; it has ovate leaves and rather short capsules while Sullivant figures an elliptical-oblong leaf and a much larger capsule. The plants corresponding to Hedwig's figure grow in places that are dry at times, and its leaves are regularly and closely imbricated on the stout, terete branches. The regularity of imbrication gives a very striking appearance like the shingles of a roof. The plants corresponding to Sullivant's figure grow on rotten wood and in more moist situations; the branches are more slender, the leaves less abruptly apiculate and less closely and regularly imbricate. Sullivant's figure, l. c., of the mouth of the capsule is incorrect; he figures the mouth of the capsule as it appears when first mounted in water, but when cleared up with glycerine it will be seen that 2 or 3 of the upper rows of cells are small annulus cells. Var. *lanceolatus* is characterized principally by its lanceolate leaves and var. *minor* by its short capsules, var. *Demetrii* by its strongly flattened stems and branches.

3. ENTODON COMPRESSUS (Hedw.) C. Muell. Linnaea, 18: 707. 1844.

Leskea compressa Hedw. Sp. Musc. 232. pl. 56. f. 1-7. 1801.

Cylindrothecium compressum Br. & Sch. Bryol. Eur. fasc. 46-47. 1851.

Gametophyte in thin dirty green mats; stem and branches complanate-foliate and lying in the same plane, as in *E. cladorrhizans*, but both much more slender; stems often much divided, 2-5 cm. long, subpinnately branching; branches short; leaves becoming appressed in drying, causing the plants to lose their flattened appearance in a measure; branch leaves oblong-ovate, 1.1 mm. long by half as wide, obtuse, with apiculation very short or none, entire or slightly denticulate at apex, very concave; costa short and double; median leaf cells linear, 11: 1; basal cells quad-

rate; stem leaves larger, proportionately broader, entire: monocious; male branches small; antheridia few, subcylindric; inner perigonial leaves ovate, acute, ecostate, bordered by a row of narrow cells: perichaetium 1.5–2 mm. long, sheathing; inner leaves oblong-lanceolate, very gradually acuminate, entire, slightly bicositate; leaf cells linear above, rhomboidal below. *Sporophyte* 12–15 mm. high; seta light reddish-brown; capsule brown, elongated-ovoid, contracted below mouth, 2.5 mm. long, 4:1; operculum conic-rostrate, with a slender inclined beak; annulus compound, persistent, of 3 rows of cells; peristome about 0.3–0.4 mm. long; teeth narrowly linear-lanceolate, closely and regularly articulate, densely and minutely papillose; segments linear, shorter than the teeth, usually broken off, minutely papillose; spores very minutely roughened, 11–13 μ , maturing in autumn.

Type locality, Lancaster, Penn. (Muhlenberg).

On earth and rotten logs in the shade, roots of trees near water courses.

Rhode Island, New Jersey, Ohio, Illinois, Kansas, Nebraska, Missouri. Not common.

ILLUSTRATIONS.—Hedw. l. c.; Sull. Icon. Musc. *pl.* 93.

EXSICCATI.—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 264, (Ed. 2) 388 in part, mixed with *E. seductrix minor*.

Easily distinguished by its short ovoid capsules and long minutely papillose peristome.

4. ENTODON SULLIVANTII C. Muell. Can. Rec. Sci. 1894: 21. 1894.

Neckera Sullivantii C. Muell. Syn. Musc. 2: 65. 1851.

Cylindrothecium Sullivantii Sull. in A. Gray, Man. Ed. 2: 664. 1856. Also Icon. Musc. 149. *pl.* 95.

Gametophyte in rather thin, glossy-green mats; stems 3–5 cm. long, pinnately branching; stem and branches slender, complanate-foliate, lying in the same plane; branches 5–15 mm. long; branch leaves ovate-lanceolate, 1.1 by 0.4 mm., acute, serrate at apex, very concave, margins incurved; costa short and double; median cells linear-rhomboidal, 8:1; quadrate alar cells numerous, extending nearly or quite to costa at base; stem leaves much larger, 1.6 mm. long, broadly ovate-lanceolate, entire except at ex-

treme apex: male branches elongated-ovoid; perigonal leaves oval-oblong, concave, with a short broad acumination: perichaetium 1.5–2 mm. long; inner leaves erect, loosely sheathing, oval-oblong, acuminate, entire or serrulate at apex, ecostate, leaf-cells of upper half linear-rhomboidal, gradually much broader and looser below. *Sporophyte* 1.8–2.5 cm. high; seta orange; capsule brown, cylindric, 3.5–4 mm. long, 5–7:1; operculum conic-rostrate; annulus very large, compound, of 3–4 rows of cells; peristome nearly 0.4 mm. long; teeth linear-lanceolate, orange, closely and regularly articulate; upper part of teeth with articulations more distant, marked with a double line, irregularly striolate with striolae vertical to oblique; obscurely striolate below with horizontal striolae; segments a little shorter than teeth, linear from a lanceolate base; spores minutely roughened, about 13μ .

Type locality in woods along the French Broad River, N. Carolina (Sullivant).

On damp rocks in woods.

North Carolina (Gray and Sullivant); Tennessee (Lesquereux); South Carolina. Very rare.

Reported from Japan. *Vide* Jaeger, *Adumbratio*.

ILLUSTRATIONS.—Sull. l. c.

EXSICCATI.—Sull. *Musc. Allegh.* 64, (*Leskea compressa*); Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 263, (Ed. 2) 389.

Easily distinguished from *E. compressus*, which it resembles, by its more slender stem and branches, serrate leaves, longer capsule, and striolate teeth.

5. *ENTODON DRUMMONDII* (Br. & Sch.) Jaeger & Sauerb. *Ber. St. Gall. Nat. Gesell.* 1876–77: 282.

Cylindrothecium Drummondii Br. & Sch. *Bryol. Eur.* fasc 46–47. 1851.

Neckera cladorrhizans Hook. & Wils. *Drumm. Musc. Am.* (S. States) 96. 1841.

Gametophyte in rather thin yellowish green mats; stems 4–8 cm. long, complanate-foliate, subpinnately branched; branches lying in one plane, short; branch leaves loosely imbricate, oblong-lanceolate to ovate-lanceolate, 1.8 by 0.5–0.7 mm., acute, serrate at apex, smooth, concave, ecostate; upper cells linear, 15:1; basal

enlarged, rhomboidal, quadrate at the angles; stem leaves shorter and broader with more enlarged and hyaline basal cells: monoicous; male branches borne on stem or branches; antheridia oblong; paraphyses numerous and large; perigonial leaves oval to short-oblong, concave, the inner with a short, broad acumination: perichaetium about 2.5 mm. long; outer leaves sheathing at base with tips more or less spreading; inner nearly erect, oblong, long acuminate with a few long spreading teeth at apex; leaf-cells linear above, gradually enlarged to rhomboidal or quadrate at base. *Sporophyte* 10–25 mm. high; seta yellow; capsule brown, cylindric, 2–2.5 mm. long, 4:1; operculum long-conic, apiculate; mouth of capsule bordered by two or three rows of horizontally compressed cells, above these a row of enlarged cells without a cavity, closely simulating non-vesicular annulus cells; peristome about 2.5 mm. long; teeth linear-lanceolate, smooth and hyaline above, striolate and often thicker, brown and perforate below; segments linear, nearly or quite as long as teeth; spores minutely roughened, 13–15 μ , apparently maturing in spring, but data insufficient.

Type locality, Louisiana (Drummond).

On trees, rocks and logs, in woods. Southern United States east of the Mississippi, north to Tennessee and North Carolina; northern Mexico (Pringle).

ILLUSTRATIONS.—Sull. Icon. Musc., *pl.* 94.

EXSICCATI.—Drumm. Musc. Am. (S. States) 96 type; Sull. & Lesq. (Ed. 1) 264, (Ed. 2) 390. Aust. Musc. Appal. Suppl. 538; Ren. & Card. Musc. Am. Sept. Exsic. 91. Macoun's Can. Musc. 436 is not this species.

Distinguished at sight from *E. cladorrhizans* and *E. compressus* by its very wide flattened branches and yellow seta.

6. ENTODON REPENS (Brid.) Grout, Bull. Torr. Club, 23: 227. 1896.

Pterigynandrum repens Brid. Musc. Recent. Suppl. 1: 131. 1806.

Platygyrium repens Br. & Sch. Bryol. Eur. fasc. 46–47. *pl.* 458. 1851.

Pterogonium repens Schwaegr. Suppl. 1¹: 100. *pl.* 27. 1811.

Neckera repens Schwaegr. Suppl. 3¹: Sect. 2. *pl.* 246. 1828.

Cylindrothecium repens De Not. Epil. 214. 1869.

Gametophyte in rather thin intricate mats, varying from dark green to a lighter yellowish green; stems 2–6 cm. long, prostrate; branches short, cylindric, ascending, often slightly curved; ends of sterile branches often bearing numerous small gemmae in the axils of the leaves; leaves oblong-ovate to oblong-lanceolate, closely imbricate when dry, 0.7–1.2 mm. long by 0.3–0.4 mm. wide, acute to acuminate; margins recurved and entire; costa lacking or short and double in robust plants; apical cells rhomboidal, median linear, 8:1; quadrate alar cells numerous and extending up the margin of leaf; stem leaves larger and proportionally broader: dioicous; male branches not abundant; antheridia oblong, large, stipitate; perigonial leaves bordered by a row of narrow cells, short-oblong, concave, slightly narrowed at base: perichaetium 1.5 mm. long, sheathing below, spreading above; inner leaves oblong, long acuminate, denticulate at apex, usually with a short thin double costa, upper cells linear, alar enlarged and rectangular. *Sporophyte* 2–3 cm. high; seta brown; capsule erect, about 3 mm. long, 4:1, brown; operculum conic-rostrate; annulus large, of three rows of cells; peristome 3–4 mm. long; teeth linear-lanceolate, hyaline-margined, orange, with raised lines at base; segments linear, usually free at base, nearly as long as teeth; spores minutely roughened, 14μ , maturing in early autumn.

Type locality, Switzerland.

On bark of trees, decaying logs and stumps. Europe, and North America east of the Rocky Mountains. Common.

ILLUSTRATIONS.—Schwaegr. l. c.; Br. & Sch. l. c.; Lesq. & James, Mosses of N. A. *pl.* 5.; Husnot, Musc. Gall *pl.* 89.; Limpr. Rab. Krypt. Fl. 4³: f. 353.

EXSICCATI.—Drumm. Musc. Am. (S. States) 98 and Musc. Am. 159 (*Neckera sericea*). Sull. Musc. Allegh. 45; (*Neckera sericea*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 259, (Ed. 2) 385; Austin, Musc. Appal. 281; Ren. & Card. Musc. Am. Sept. Exsic. 235.

- 6a. ENTODON REPENS ORTHOCLADOS (Kindb.) Grout, Bull. Torr. Club, 23: 227. 1896.

Platygyrium repens orthoclados Kindb. in Macoun, Cat. Can. Pl. 6: 172. 1892.

Platygyrium repens sciuroides Limpr. Rab. Krypt. Fl. 4³: 7. 1896.

Platygyrium repens ramulis elongatis Bryol. Eur. pl. 458. f. 3. Glossy, yellowish green. Branches much larger and longer; leaves larger, 1.2×0.4 mm., loosely imbricate, shortly bicostate.

Type from Skeads' Farm near Ottawa (Macoun).

EXSICCATI.—Sauter in Breut. Musc. Frond. Exsic. 296; Macoun, Can. Musc. 259 in part.

This variety seems to me to be only a robust form of a variable species. It was not considered by Schimper as worthy of varietal rank, although he figures the form. I have seen Dr. Sauter's type and also Kindberg's and they are without doubt the same. Kindberg's criticisms in Macoun's Catalogue on the descriptions and plates of this species are entirely without point. The Columbia College specimens of Macoun's no. 259 contained no fragment of *Platygyrium*, but consisted of *Pylaisia polyantha*.

Every character that has been supposed to separate this species from the genus *Entodon*, is possessed by some other member of the genus as here constituted, hence, in spite of its unlike appearance it seems best to place it here.

7. ENTODON ORTHOCARPUS (La Pyl.) Lindb. Musc. Scand. 39. 1879.

Hypnum Schreberi orthocarpum Brid. Bryol. Univ. 2: 422. 1827.

Hypnum orthocarpum La Pylaie; Brid. Bryol. Univ. 2: 422. 1827.

Cylindrothecium Montagnei Br. & Sch. Bryol. Eur. fasc. 46-47, pl. 465. 1851.

Cylindrothecium concinnum Schimp. Syn. 515. 1860.

Gametophyte in wide loosely intricate yellowish green tufts; stems 2-10 cm. or more long, suberect, pinnately branching; stems and branches terete to somewhat complanate-foliate, rigid; branches about 1 cm. long, tapering; branch leaves oval-oblong, 1.2×0.6 mm. obtuse, entire, very concave, with involute margins, ecostate or short bicostate; upper cells fusiform, much shorter and

broader at apex, median about 10:1, basal strongly porose; quadrate alar cells numerous, small, extending up the margin of leaf, densely chlorophyllose, 2-3 layered in the central alar area; stem leaves larger and broader cells narrower and longer: dioicous; perigonial leaves oval, obtusely acuminate, ecostate; antheridia large, inflated: perichaetium about 2 mm. long, loosely sheathing; the inner leaves large, oblong, gradually narrowed above, obtusely acute, entire; median leaf-cells linear, lower rhomboidal. *Sporophyte* 2-2.5 cm. high; seta dark red-brown; calyptra dimidiate, long, descending to below the base of capsule; capsule brown, erect, cylindric, 3 mm. long, 5:1; operculum conic-rostrate, beak often oblique; annulus of 2-3 rows of small cells; peristome about 0.3-0.5 mm. long; teeth linear-lanceolate, red-brown, and closely articulate below, orange and distinctly articulate above, with a very distinct median line along which the tooth is often perforate or split; segments linear, as long as the teeth or longer; "basal membrane none;" spores minutely roughened, about 15μ , maturing in autumn.

Type locality, France (La Pylaie).

Very rare and sterile. Colorado (Brandeggee). Middle Arm, Newfoundland (Rev. A. C. Waghorne).

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, Musc. Gall. *pl.* 89.

This species is quite common in Europe, but mostly sterile. It has been collected only twice in America. The American specimens in the Columbia herbarium are all sterile and I suspect that all of Brandeggee's and Waghorne's collection lacked fruit. The fruit is described from a European specimen.

8. ENTODON BREVISETUS (Hook. & Wils.) Jaeger & Sauerb. Ber. St. Gall. Nat. Gesell. 1876-77: 291.

Neckera breviseta Hook. & Wils. Lond. Jour. Bot. 4: 419. *pl.* 24 *f. a.* 1842.

Cylindrothecium brevisetum Br. & Sch. Bryol. Eur. fasc. 46-47. 1851.

Gametophyte in wide densely intricate mats, dark green below, tips of short branches lighter; stems varying greatly in length, averaging about 5 cm., creeping, subpinnately branching; branches short, suberect, abruptly tapering at end, lower often radicu-

lose at tip; leaves closely imbricate when dry; branch leaves lanceolate, 1.9×0.6 mm., gradually narrowly acuminate, entire or slightly serrulate at apex, concave; costa double, extending nearly $\frac{1}{4}$ length of leaf; median cells oblong-hexagonal with length 6 times diameter; alar and basal cells quadrate, chlorophyllose; stem leaves larger, ovate-lanceolate: monoicous; male branches frequent; antheridia numerous, oblong-ovoid, stipitate; perigonial leaves bordered by a row of elongated cells, inner oblong-obovate, short acuminate: perichaetium 3.5 mm. long; the outer leaves sheathing at the base with squarrose tips; the inner erect, oblong-lanceolate, long acuminate, entire; costa double, ending below the middle; leaf-cells linear above, rhomboidal below. *Sporophyte* 10–20 mm. high; seta light reddish brown; capsule brown, 2.5–3 mm. long, 5:1, cylindric-ovoid, contracted below the mouth when dry; operculum long-conic, obtuse; annulus compound, of 3 rows of cells; peristome 0.3 mm. long; teeth linear-lanceolate, reddish brown, closely and regularly articulate, nodulose at articulations above, bordered the entire length by the adherent segments; spores tuberculate, 21μ , maturing in autumn.

Type locality, Missouri, near St. Louis (Drummond).

On trees, limestone rocks, etc., New Jersey, Virginia, Pennsylvania, Ohio, Missouri; Canaan Forks, New Brunswick (J. Moser). Not common.

ILLUSTRATIONS.—Hook. & Wils. l. c.; Sull. Icon. Musc. *pl.* 96.

EXSICCATI.—Drumm. Musc. Am. (S. States) 95, (Type); Sull. Musc. Allegh. 79; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 265, (Ed. 2) 391.

This species is readily distinguished from all others by its narrowly acuminate leaves and the adherent segments of the inner peristome. The locality given in the Manual of Lesq. & James must be a mistake, as I have been able to obtain no specimens from the western United States. The male and female organs seem to have a tendency to appear in alternate seasons on the same plant.

DOUBTFUL OR EXCLUDED SPECIES.

ENTODON MACOUNII C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 177. 1892.

Authentic specimens from type locality in Herb. Macoun are not referable to *Entodon* at all, but are one of the complanate-foliate Hypneae. Capsules are needed to classify them. There are no quadrate alar cells and the cells at the angles are so little enlarged as to be scarcely noticeable.

ENTODON SUBFLACEUS C. Muell. & Kindb. Can. Rec. Sci. 1894: 21. 1894.

Professor Macoun says in a recent letter, "You will notice that *Hypnum subflaccum* is really what is also described as "*Entodon Macounii*." This was Kindberg's second name. His first was *C. Drummondi*. His third was *H. subflaccum*."

ENTODON (?) EXPALLENS C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 177. 1892.

This species belongs to the same group as *E. Macounii*.

CYLINDROTHECIUM FLORIDANUM Duby, Regensb. Flora, 58: 284, is probably not related to *Entodon*, as the horizontal capsules described are not in accordance with the characters of the genus. We have not been able to obtain a specimen of it, as the type cannot be found in the Duby nor the Boissier herbaria at Geneva.

2. PYLAISIELLA Kindb. Can. Rec. Sci. 1894: 21. 1894.

[PYLAISIA Br. & Sch. Bryol. Eur. fasc. 46-47. 1851. Not Desv. 1814.]

Gametophyte in rather thin glossy green mats. Stems creeping, subpinnately branching. Branches short, erect or ascending, more or less recurved at the tips by reason of the strongly secund apical leaves; not radiculose. Leaves erect-spreading, somewhat falcate-secund, especially when dry, acuminate, concave, ecostate or costa short and double; leaf cells linear, quadrate at the basal angles. Monoicous; paraphyllia none. Male branches gemmiform, borne on stem or branches. Female branches usually borne on the stem. *Sporophyte* with seta smooth, twisted to left above, to right below. Calyptra cucullate. Capsule erect, seldom slightly incurved; operculum conic or short rostrate. Columella persistent, annulus narrow. Peristome double, inserted below

mouth of capsule; segments attached to a wide basal membrane, free or adhering to teeth; cilia rudimentary or none. Spores minutely roughened.

Widely distributed in the north temperate zone.

The generic name *Pylaisia* was first used by Desvaux in 1814 to designate a new genus named in honor of De La Pylaie. The specimen upon which his genus was founded is stated to be nothing more than a depauperate form of *Hypnum denticulatum* L.

In 1851 Bruch and Schimper took up the name for a new genus founded on *Hypnum polyanthos* Schreb., thus publishing a homonym. DeNotaris in 1869 extended the genus *Pylaisia* by including *Orthothecium* of the Bryol. Eur., and in this extended form it was degraded by Lindberg in 1879 to a sub-genus of *Stereodon* of Mitten. The name *Pylaisiella* proposed by Kindberg for two species of the genus, viz.: *P. velutina* and *P. subdenticulata*, is very appropriate, as it will commemorate the name of De La Pylaie.

Segments of the endostome entirely free from the teeth.

Operculum conic; quadrate alar cells few.

1. *P. polyantha*.

Operculum short-rostrate; quadrate alar cells numerous.

2. *P. subdenticulata*.

Segments partially or wholly adherent to the teeth.

Partially adherent; spores 18-24 μ .

3. *P. intricata*.

Wholly adherent; spores 25-30 μ .

4. *P. velutina*.

1. PYLAISIELLA POLYANTHA (Schreb.) Grout, Bull. Torr. Club, 23: 229. 1896.

Hypnum polyanthos Schreb. Spicil. Flor. Lips. 97. 1771.

Pylaisia polyantha Br. & Sch. Bryol. Eur. fasc. 46-47. pl. 455. 1851.

Stereodon polyanthos Mitt. Journ. Linn. Soc. 8: 40. 1865.

Pylaisia heteromalla Br. & Sch. Lond. Journ. Bot. 2: 669. 1843.

Hypnum polyanthum pallidifolium C. Muell. Syn. 2: 337. 1851.

Pylaisia Ontariense C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 174. 1892.

Gametophyte in glossy yellowish green intricate mats; stems 2 to 10 cm. long, rarely longer, creeping, pinnately branching; branches 0.5 to 1 cm. long, erect or ascending; branch leaves somewhat falcate-secund, loosely imbricate when dry, broadly ovate-lanceolate, 1-1.3 $\times$ 0.4-0.5 mm., more or less long-acumi-

nate, entire, slightly concave, ecostate, or costa very faint, short and double; leaf-cells linear-rhomboidal; median cells 8 : 1; quadrate alar cells few; stem leaves broader, more abruptly acuminate: antheridia oblong; perigonial leaves broadly ovate-lanceolate, entire, acute to acuminate: perichaetium 2 mm. long; the leaves loosely sheathing, squarrose at apex; inner oblong-lanceolate, more or less long-acuminate, more or less serrate at apex, ecostate; cells linear above, rhomboidal and hyaline below. *Sporophyte* 1–2 cm. high; seta red-brown; capsule lighter red-brown, oblong-cylindric, 2.5 mm. long, 3.5–4 : 1, often stomatose at base; operculum conic to conic-apiculate; annulus very narrow and easily detached, of one row of cells; teeth of peristome linear-lanceolate, closely and regularly articulate, sub-moniliform and slightly granular above; segments as long as teeth, linear-lanceolate, strongly carinate, more or less split when old, granular-roughened; spores brownish yellow, minutely roughened, 14μ , maturing in autumn and winter.

Type locality European.

On stems and roots of trees. Not common.

Canada and northwestern United States (Macoun); Kakabeka Falls, Ont. (Mrs. Britton); Saskatchewan and Rocky Mountains (Bourgeau); Santa Fé (Fendler); White Mountains (James); Montana (R. S. Williams); Pike's Peak, Colo. (S. L. Clarke); Minnesota (F. F. Wood); Mt. Desert (Rand, Flora Mt. Desert, 212). Apparently widely distributed in Canada and along the northern border of the United States in mountainous regions, but rather infrequent and local.

ILLUSTRATIONS.—Dill. Hist. Musc. *pl.* 42. *f.* 62 (*Hypnum sericeum ramosius et tenuis*); Hedw. St. Cr. 4: *pl.* 2. (*Leskea polyantha*) Br. & Sch. 1. c.; Husnot. Musc. Gall. *pl.* 89; Rab. Krypt. Fl. 4³: *f.* 354.

EXSICCATI.—Drumm. Musc. Am. 222; Aust. Musc. Appal. Suppl. 1. 537; Macoun, Can. Musc. 260 (in part).

The typical American form of this species is quite variable in leaf characters even on the same plant, but it differs constantly from European specimens in that the leaves are shorter, more abruptly acuminate and more broadly ovate-lanceolate. The length of the leaf of the European form averages 1.5 mm., that

of the American 1 mm., though I have found one plant whose leaves measured 1.4 mm. The length of the acumination of the perichaetial leaves is also very variable. It may be that our forms of this and the next species are but two varieties of the European *P. polyantha*. The American *polyantha* answers very closely to the description of *P. polyantha brevifolia* Lindb. & Arnell, Musc. Asiae-bor. 152. 1890. I have seen the type specimens of *P. heteromalla* from Schimper's herbarium and not only are they *P. polyantha*, but Schimper himself indicated clearly on his labels that he did not consider it a good species; Drummond's no. 222 on which this species was founded, is evidently somewhat mixed as the Columbia Herbarium specimen is *P. intricata*.

1a. PYLAISIELLA POLYANTHA JAMESII (Sull.) E. G. Britton, Bull. Torr. Club, 23: 230. 1896.

Pylaisia Jamesii Sull. & Lesq. Musc. Bor. Am. Ed. 2. 383. 1865.

Pylaisia subdenticulata obscura Lesq. & James, Mosses North America, 309. 1884.

Gametophyte smaller than in the typical form; leaves shorter, broadly ovate-lanceolate, shortly bicostate; length of leaf-cells 4-6 times their diameter; quadrate alar cells numerous; perichaetial leaves shorter, abruptly acuminate. *Sporophyte* with shorter subulate-lanceolate peristomal teeth, which are also shorter than the segments.

On the ground and roots of trees. Chelsea, Mass. (James).

This variety has the appearance of *P. subdenticulata* because of its reduced size, otherwise it has the characters of American *polyantha*, such as conic operculum and rudimentary cilia.

1b. PYLAISIELLA POLYANTHA PSEUDO-PLATYGYRIA (Kindb.) Grout, Bull. Torr. Club, 23: 230. 1896.

Pylaisia pseudo-platygyrium Kindb. in Macoun, Cat. Can. Pl. 6: 173. 1892.

Pylaisia filari-acuminata Kindb. l. c. 174.

Leaves narrowly long-acuminate; upper branch leaves distantly serrate-dentate along sides of acumination; inner perichaetial leaves often long-acuminate, serrate-dentate along the acumination; cilia 1 or 2, better developed than in the type.

Type locality, shores of Lake Nipigon, Ontario. Also found on the west side of the Columbia river at Revelstoke, B. C.

On decayed trunks and on "logs subject to inundation."

EXSICCATI.—Macoun, Can. Musc. 626. (*Pylaisia filari-acuminata*.)

2. PYLAISIELLA SUBDENTICULATA (Schimp.) Kindb. Can. Rec. Sci. 1894: 22. 1894.

Pylaisia subdenticulata Schimp. Bryol. Eur. fasc. 46–47. 1851.

Pylaisia denticulata Sull. in A. Gray Man. Ed. 2: 52. 1856.

Gametophyte darker green than the last, scattering or in thin mats, often closely intermixed with other species; stems 1–3 cm. long, irregularly divided, subpinnately branching; branches very short, usually less than 5 mm. long; branch leaves erect-spreading, ovate-lanceolate, 0.7–1 × 0.2–0.35 mm., gradually long-acuminate, more or less denticulate especially above, concave, ecostate or costa thin, short and double; median cells 6–8:1; quadrate alar cells numerous; perigonal leaves ovate-lanceolate, acuminate, concave; antheridia oblong; perichaetium 1.5–2 mm. long, loosely sheathing; inner leaves ovate-lanceolate, gradually or abruptly narrowed to a long point, more or less denticulate above, ecostate; leaf-cells linear-fusiform above, broader and rhomboidal below. *Sporophyte* 8–17 mm. high; seta brown; capsule brown, cylindric, 1.5–2 mm. long, 4–5:1; operculum conic, short-rostrate; annulus very narrow, consisting of a row of isodiametric polygonal cells and a row of vesicular cells that often come off with the operculum; teeth of peristome linear-lanceolate, orange, closely and regularly articulate, submoniliform and granulose above; segments linear-lanceolate, a little longer than the teeth, more or less split above; cilia lacking; spores yellow-brown, minutely roughened, 10–12 μ , maturing in summer or early autumn.

Type locality American (Sullivant).

On trees. New York and New Jersey (Austin); Maryland (Holzinger); Ohio (H. J. Biddlecome); Athens, Ill. (Hall); New Mexico (E. O. Wooton).

ILLUSTRATIONS.—Sull. Icon. Musc. pl. 87.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 382.

Very close to *P. polyantha*, but distinguished by the reduced size, rostrate operculum, absence of cilia and numerous quadrate alar cells.

3. *PYLAISIELLA INTRICATA* (Hedw.) Grout, Bull. Torr. Club, 23: 231. 1896.

Pterigynandrum intricatum Hedw. Sp. Musc. 85. pl. 18. 1801.

Pylaisia intricata Schimp. Bryol. Eur. fasc. 46-47. 1851.

Hypnum intricatum C. Muell. Syn. 2: 338. 1851.

Stereodon intricatus Lindb. Musc. Asiae-bor. 2: 151. 1890.

Pylaisia Selwynii Kindb. Ott. Nat. 2: 156. 1889.

Gametophyte in wide glossy-green intricate mats; stems 5-8 cm. long, creeping, pinnately branching; branches about 5 mm. long, erect or ascending, strongly recurved at tips, especially when dry; branch leaves secund, especially at the ends of the branches, ovate-lanceolate, 0.8-1.1 × 0.3-0.4 mm., more or less long-acuminate, entire or subdenticulate at apex, concave, ecostate or costa short, thin and double; median cells linear-fusiform, 7-12:1; quadrate alar cells numerous, bordering the lower $\frac{1}{3}$ of leaf; stem leaves ovate to broadly ovate-lanceolate, more abruptly acuminate, costa short and double; leaf-cells broader, linear-rhomboidal; male branches abundant; antheridia elongated-ovoid; perigonial leaves broadly ovate-lanceolate, acuminate; perichaetium 2-2.5 mm. long, loosely sheathing; inner leaves oblong-lanceolate, acuminate, denticulate above, costa diffuse, reaching middle; leaf-cells linear above, looser, rhomboidal and strongly porose below. *Sporophyte* 12-17 mm. high; seta dark red-brown; capsule red-brown, ovoid to ovoid cylindric, symmetric, slightly narrowed at mouth, 2 mm. long, 3-4:1; operculum conic, erect or oblique; annulus of about 2 rows of cells; teeth of peristome subulate-lanceolate, closely and regularly articulate, light yellow-brown; segments longer than the teeth, adherent for $\frac{2}{3}$ their length, split below, united above; spores yellow-brown, minutely roughened, thick walled, 18-24 μ , maturing in autumn.

Type locality, Lancaster, Penn. (Muhlenberg).

On trees, old logs, etc.

Common in the northeastern United States and eastern Canada; Kansas, Missouri, Mississippi, Georgia (Ravenel), Florida (Chapman).

ILLUSTRATIONS.—Hedw. l. c.; Sull. Icon. Musc. *pl.* 88; Gray's Man. Ed. 2, *pl.* 5; Lesq. & James, Mosses of North America, *pl.* 5.

EXSICCATI.—Sull. Musc. Allegh. 34; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 256, (Ed. 2) 380; Macoun, Can. Musc. 262; Ren. & Card. Musc. Am. Sept. Exsic. 89.

This species is easily distinguished by its curved branches, numerous quadrate alar cells and partially adherent segments. It varies a great deal in length of leaves and in length of leaf-cells, length and color of capsule and size of spores. Authentic specimens of *Pylaisia Selwynii* Kindb. show that it is merely a form of this species growing in exposed dry places. The plants are darker and the leaves more strongly recurved than usual.

4. PYLAISIELLA VELUTINA (Schimp.) Kindb. Can. Rec. Sci. 1894: 21. 1894.

Pylaisia velutina Schimp. Bryol. Eur. fasc. 46-47. 1851.

Gametophyte in wide glossy yellow-green mats; stems 5 cm. or more long, creeping; branches 5-10 mm. long, ascending, curved at tip; branch leaves loose, secund, especially when dry, ovate-lanceolate, 0.8-1.2 by 0.3 mm., more or less long-acuminate, entire or denticulate along the somewhat involute margin, concave, ecostate, or costa short, faint and double; median cells linear-fusiform, 8-10 : 1; quadrate alar cells few; stem leaves much broader: antheridia stipitate, elongated-ovoid; inner perigonal leaves oblong-ovate to broadly ovate-lanceolate, acuminate: perichaetium 2 mm. long; leaves loosely erect, the inner oblong-lanceolate, long-acuminate, somewhat denticulate at apex; leaf-cells linear above, linear-rhomboidal and porose below. *Sporophyte* 1.2-1.7 cm. high; seta brown; capsule brown, ovoid-cylindric, 2 mm. long, 4:1; operculum conic, strongly apiculate to short-rostrate; annulus narrow, of 2 rows of small cells; teeth of peristome yellow-brown, linear-lanceolate, very closely articulate, bordered the entire length by the adhering segments; spores thick-walled, finely papillose, dark yellow brown, 24-30 μ , maturing in late summer or early autumn.

Type locality American, (Sullivant).

On bark of trees, old logs, etc.; New Brunswick, and Mt. Desert, Maine, south to North Carolina, west to Ohio and Indiana.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 89.

EXSICCATI.—Sull. Musc. Allegh. 60; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 257, (Ed. 2) 381; Aust. Musc. Appal. 294; Macoun, Can. Musc. 470.

Distinguished from *P. intricata* by the entirely adherent segments; narrower leaves with fewer quadrate alar cells, and larger spores.

PYLAISIA REVOLUTIFOLIA Kindb. in Herb. Macoun, from Leamington, Ont., August 4, 1892, and Pelee Point, Ont., is *Entodon repens*.

3. HOLMGRENIA Lindb. Öfv. Vet.-Ak. Förh. 19: 605. 1863.

[ORTHOTHECIUM Br. & Sch. Bryol. Eur. fasc. 48. 1851. Not Schott. & Endl. Melet. Bot. 31. 1832.]

Gametophyte in wide glossy bright colored mats (except *H. intricata*). Primary stems irregularly divided, sparsely branching. Paraphyllia lacking. Leaves erect, ascending, not decurrent, usually entire or sometimes slightly serrulate, acuminate, concave; costa short and double or lacking; median leaf-cells linear; basal cells shorter and broader; alar little differentiated. *Sporophyte* rare. long-pedicelled; seta smooth. Calyptra small, fugacious. Capsule nearly or quite erect and symmetric; operculum conic; annulus large. Peristome double; the teeth narrowly lanceolate; segments lanceolate, as long as teeth, from a broad basal membrane; cilia short or lacking.

Gametophyte large (5–10 cm. high); leaves strongly plicate.

1. *H. chrysea*.

Gametophyte small (2–4 cm. high); leaves not plicate.

Leaves ovate.

2. *H. stricta*.

Leaves narrowly lanceolate.

3. *H. intricata*.

1. HOLMGRENIA CHRYSEA (Schwaegr.) Lindb. Öfv. Vet.-Ak. Förh. 19: 605. 1863.

Hypnum chryseum Schwaegr. Schulte's Reise auf d. Glockner, 2: 364. 1804.

Orthothecium chryseum Br. & Sch. Bryol. Eur. fasc. 48. *pl.* 461. 1851.

Isothecium chryseum Spruce, Annal. & Mag. Nat. Hist. 1849.

Leskea chrysea Hartm. Skand. Flor. Ed. 6. 1854.

Stereodon chryseus Mitt. Journ. Linn. Soc. 8: 39. 1864.

Gametophyte in thick glossy golden tufts ; stems 5–10 cm. long, erect, simple or 2–3 parted, radiculose at base ; leaves pluriseriate, imbricate, ovate-lanceolate to triangular ovate, 1.3–2 x 0.4–0.8 mm., apiculate to short acuminate, curved, strongly plicate, nearly ecostate ; margins entire, recurved ; median cells linear, 12–14 : 1 ; basal cells somewhat shorter and broader, thick-walled and golden brown : dioicous ; male branches gemmiform ; antheridia short stipulate ; paraphyses few, filiform ; perigonial leaves ovate, concave, acute to acuminate, serrate at apex : perichaetium 1.5–2 mm. long ; leaves few, triangular-ovate, golden brown with several layers at base ; the inner long-acuminate, sharply toothed, not plicate. *Sporophyte* 2–3 cm. high ; seta golden brown, smooth ; capsule ovoid-cylindric, slightly unsymmetric, contracted under the mouth when dry ; operculum conic ; annulus of two rows of cells, easily deciduous ; peristome double ; the teeth linear-lanceolate, closely articulate, hyaline and granulose-roughened above ; segments from a very wide basal membrane as long as teeth, somewhat perforate along the keel ; cilia two, shorter ; spores 12–16 μ , roughened.

Type locality European.

On moist rocks and stony slopes, in alpine or boreal regions. Rare and rarely fruiting. Rocky Mountains (Drummond, Macoun) ; Saskatchewan (E. Bourgeau) ; Columbia Falls, Montana (R. S. Williams) ; Colorado (Brandege).

ILLUSTRATIONS.—Br. & Sch. l. c. ; Husnot, *Musc. Gall.* 316. *pl.* 90.

2. *HOLMGRENIA STRICTA* Lörentz, *Moos Stud.* 122. *pl.* 5. 1864.

Stereodon rubellus Mitt. *Journ. Linn. Soc.* 8 : 40. 1865.

Orthothecium rubellum Kindb. *Laubm. Schwed. u. Norw.* 46. 1883.

Orthothecium intricatum var. *rubellum* Husnot, *Musc. Gall.* 173. 1893.

Gametophyte caespitose, orange colored, glossy ; stems erect, 1.5–2 cm. long ; branches few ; lower branch leaves elongated ovate ; upper ovate-lanceolate, 1 x 0.3–0.4 mm., not plicate or sulcate, ending in a flexuous subhyaline acumination ; margins revolute, serrulate above ; costa short and double ; median leaf-

cells oblong-linear, 6–8:1; basal cells shorter, brownish yellow; alar cells not conspicuously quadrate; stem leaves larger, 1–1.4 mm. long: dioicous; perichaetial leaves ovate-lanceolate. *Sporophyte* lacking.

Type locality European.

Davis Strait (Taylor).

In several sets of Drummond's mosses no. 73, from the Rocky Mountains (distributed as *Catoscopium nigrum*), there is no trace of this species. Dr. Mitten kindly sent a portion of the Davis Strait plant and says that the Taylor who collected these specimens was a ship's surgeon and not the Dr. T. Taylor whose herbarium is at Harvard.

"A small moss with all the habit, appearance and color of *Orthothecium intricatum* Br. & Sch., but differing in its almost exactly ovate leaves, with a short sometimes discolored apiculus, the margins revolute, and the areolation composed of cells which are twice as wide." (*Mitten.*)

3. HOLMGRENIA INTRICATA (Hartm.) Lindb. Öfv. Vet. Ak. Förh. 19: 605. 1863.

Leskea intricata Hartm. Skand. Fl. Ed. 5: 336. 1849.

Orthothecium intricatum Br. & Sch. Bryol. Eur. pl. 462. 1851.

Leskea polyantha β *sericeola* Brid. Bryol. Univ. 2: 313. 1827.

Gametophyte in wide densely intricate mats, dark green to brownish green; stems filiform, 2–4 cm. long, creeping, somewhat stoloniferous, irregularly divided; branches short and erect or elongated and prostrate; leaves equally spreading or slightly secund, appressed-imbricate when dry, narrowly lanceolate, 0.8–1.5 x 0.2–0.4 mm. long, subulate to filiform acuminate, entire, somewhat concave, ecostate, median cells linear, 8–10:1; basal cells shorter and broader, often colored red-brown, alar cells not differentiated: dioicous; inner perichaetial leaves lanceolate, long-filiform, acuminate. *Sporophyte* 15–20 mm. high; seta twisted to the right below, to the left above; capsule erect and symmetric, red-brown, 2–2.5:1; operculum conic; annulus of two rows of cells; peristomal teeth closely and regularly articulate; segments linear, perforate along the keel, longer than the teeth, arising from a narrow basal membrane; spores 8–10 μ ; seldom fruiting.

Type locality European.

On rocks around Kicking Horse Lake, Rocky Mts., sterile, (Macoun.)

Macoun's specimens are more slender and have smaller, more filiform-pointed leaves than is usual with the European plant. The description of the sporophyte is taken largely from Limpricht's description in Rabenhorst's Kryptogamen Flora.

HOLMGRENIA RUFESCENS (Dicks.) Lindb.

Notes from Dr. Mitten indicate that *Holmgrenia rufescens* (Dicks.) Lindb. has not yet been found in North America. In a letter dated April 21, 1896, he says: "I have looked through all my specimens of *Orthothecium rufescens* and find no trace of any North American examples. All Taylor sent me are in with *O. chryseum*, as are the 221 of Drummond in both my sets. I suppose I must have mistaken one of Taylor's to be the first named."

4. CLIMACIUM Web. & Mohr, Iter Suec. 96. 1804. Also Bot. Taschenb. 252. 1807.

Gametophyte erect, dendroid, with underground creeping stems; rarely decumbent or floating. Primary stems densely radiculose; secondary simple below, fasciculately branching above. Stem and branches covered with branching filaments which are chlorophyll-bearing above. Leaves pluriseriate, decurrent; those of secondary stem squamiform, large, closely imbricated and clasping. Branch leaves smaller, crowded, imbricate. Dioicous; antheridial branches rare, scattering. *Sporophyte* with seta long, smooth, twisted to the right; calyptra dimidiate, long, embracing base of capsule. Capsule erect, cylindric. Operculum conic-rostrate, beak often oblique. Columella persistent. Annulus none. Peristome double; teeth linear-lanceolate, closely articulate, minutely papillose. Segments of endostome as long as teeth, carinate, cleft between the articulations, split to the apex when old, attached to a narrow basal membrane, minutely papillose. Spores minutely papillose.

Capsules 3-4: 1; median leaf-cells 10: 1.

1. *C. dendroides*.

Capsules 5-6: 1; median leaf-cells 2-7: 1.

2. *C. Americanum*.

1. CLIMACIUM DENDROIDES (L.) Web. & Mohr, Iter. Suec. 96. 1804. Also Bot. Taschenb. 252. *pl. 10. f. 2.* 1807.

Hypnum dendroides L. Sp. Pl. 118. 1753.

Leskea dendroides Hedw. Sp. Musc. 228. 1801.

Neckera dendroides Brid. Musc. Rec. 2²: 14. 1797.

Gametophyte bright glossy green, 7–9 cm. high; branches spreading, flexuous; branch leaves loosely imbricate, 2 x 0.7 mm., the upper oblong-lanceolate; lower ovate-lanceolate, denticulate at base, sharply serrate above, obtuse, bisulcate, costate nearly to apex; basal angles sometimes slightly enlarged; median cells linear-rhomboidal to linear-hexagonal, 7–10: 1; alar and apical cells much shorter and broader; stem leaves larger, 2–3 mm. long, ovate, entire, apiculate: perigonial leaves entire, concave; outer suborbicular, ecostate; inner short-oblong, narrowed at base, apiculate, often slightly costate; antheridia oblong; paraphyses numerous, longer than the antheridia: perichaetium about 5 mm. long; inner leaves oblong to oblong-ovate, slightly serrate at the apex, long-acuminate, thinly costate, costa often short or wanting; leaf-cells linear above, rhomboidal and brownish yellow below. *Sporophyte* 2.5–3.5 cm. high; seta reddish-brown; capsule lighter in color, cylindric, about 4 mm. long, 3–4: 1; operculum often remaining attached to columella; peristome reddish-brown; spores 13–22 μ . Fruit rare, maturing in autumn.

Type locality European, probably Swedish.

Wet ground, borders of streams, swamps and lakes, especially in the mountains; more common than is indicated by Lesq. & James in the Manual. Ranging through the northern and western part of the continent from New Brunswick to St. Paul Island, Behring sea; south to New Jersey, Colorado and California. Not recorded from Pennsylvania or the North Central States.

ILLUSTRATIONS.—Dillenius, Hist. Musc. *pl.* 40. *f.* 48; Web. & Mohr., l. c.; Schwaegr. Suppl. 1²: *pl.* 81; Br. & Sch. Bryol. Eur. *pl.* 437; Hook. & Taylor, Musc. Brit. Ed. 2. *pl.* 25; Husnot, Musc. Gall. *pl.* 90.

EXSICCATI.—Drumm. Musc. Am. 230; Austin, Musc. Appal. 286; Ren. & Card. Musc. Am. Sept. Exsic. 237.

1a. CLIMACIUM DENDROIDES OREGONENSE Ren. & Card. Bot. Gaz. 15: 59. 1890.

“Differs from the type in the leaves narrowed at base, less serrate at apex, sometimes subentire.”

Oregon, Willamette R. (L. F. Henderson). A specimen from Sauvie's Island, Oregon (C. G. Pringle no. 510), is probably referable to this variety, as the leaves are almost entire, although broader instead of narrower than in the typical form.

2. *CLIMACIUM AMERICANUM* Brid. Sp. Musc. Suppl. part 2: 45.
1812.

Neckera dendroides Americana C. Muell. Syn. 2: 122. 1851.

Gametophyte glossy green, 5–7 cm. high; branches usually straight and tapering; branch leaves closely imbricate, 2 x 1 mm.; upper oblong-lanceolate, broadly auriculate; lower ovate to ovate-lanceolate, denticulate below, sharply serrate above, more acute than in the last, bisulcate, costate nearly to apex; leaf-cells more nearly uniform than in the last; median cells oblong-hexagonal, 5–7:1; stem leaves larger, 2–3 mm. long, entire, apiculate; perigonal leaves as in the last, except less frequently costate, bordered by a row of elongated cells, sometimes slightly denticulate at extreme apex; antheridia oblong, narrowed at base; paraphyses numerous, longer than antheridia; perichaetium about 5 mm. long; the inner leaves oblong-ovate, 4–5 mm. long, slightly denticulate at extreme apex, long-acuminate, thinly costate to above the middle; the lower sometimes ecostate; cells linear above, broader and yellowish brown below. *Sporophyte* 2–3 cm. high; seta brown; capsule cylindric, brown, about 6 mm. long, 5–6:1; peristome reddish-brown, teeth sometimes slightly perforated; spores 14–18 μ , maturing in autumn; seldom fruiting.

Type locality, Lancaster, Pa. (Muhlenberg).

Swamps, wet soil and rocks, rotten logs, etc.

This species is exclusively American. It is found in the northern and eastern States, ranging from Canada to North Carolina and probably south to the Gulf; west to Minnesota, Iowa, Illinois and Missouri. "Rocky Mountains eastward," Röll in Hedwigia, 36: 46. 1897.

ILLUSTRATIONS.—Sull. Mosses of U. S. *pl.* 5. & Icon. Musc. *pl.* 97; Lesq. and James, Mosses of North America. *pl.* 5.

EXSICCATI.—Drumm. Musc. Am. 231; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 402; Austin, Musc. Appal. 287; Macoun, Can. Musc. 265.

This species closely resembles the last, but is darker in color and the branches are more strict, with leaves more closely imbricate. Under the microscope it is readily distinguished by its very broadly auriculate branch leaves.

2a. CLIMACIUM AMERICANUM KINDBERGII Ren. & Card. Bot. Gaz.
15: 1890.

C. Americanum fluitans Aust. Musc. Appal. 49. no. 289.
1870. Name only.

Stems decumbent, irregularly ramulose, often floating; dendroid secondary stems rarely present; stem leaves scattering, ovate; branch leaves ovate-lanceolate, not auriculate, but clasping by enlarged rounded basal angles, seldom sulcate; areolation nearly uniform; median cells oblong-hexagonal, 2-3:1. Seta usually much longer and more flexuous than in the species, 2-4 cm. long; teeth of peristome usually more or less perforate.

In swamps, having the range of the species and extending to the Gulf.

Typical form from Lafayette Woods, La. (Langlois).

Hastings, Ontario and Gill River, Canada (Macoun); Dells of the Wisconsin (E. G. Britton); Cambridge, Mass. (F. Boott); Wellesley, Mass. (Miss Cummings); Conn. (Eaton); New York (E. G. Britton); Del. (A. H. Commons); New Jersey (Austin); River Swamps, Fla. (Chapman).

EXSICCATI.—Austin Musc. Appal. 289; Ren. & Card. Musc. Am. Sept. Exsic. 238.

The specimens of Sull. & Lesq. Musc. Bor. Am. Ed. 2, 42. in the Columbia College Herbarium are this variety as are also Drummond's Musc. Am. (S. States) 120.

A well-marked and interesting variety which would stand as a distinct species were it not for the gradations. Frequently the typical form found on the borders of a swamp will gradually change to the variety at the water's edge. The dendroid form, which is frequent in southern swamps, closely resembles *C. dendroides* in appearance and has often been confused with it. It is easily distinguished by its areolation and elongated capsules. Its typical habit is hypnoid and is well represented by Austin's exsiccati. When growing out into the water it sometimes has the habit of a *Fontinalis* with distant leaves.

CLIMACIUM RUTHENICUM Lindb. is not a *Climacium*. Its affinities are uncertain, but is it not one of the Isotheciaceae. It has been referred to *Pleuroziopsis* by Kindberg in his check list of European and American mosses (Can. Rec. Sci. 1894: 19, 1894.) He associates it with *Hypnum splendens* Hedw. and *H. triquetrum* L. This does not seem to be its natural alliance.

HOMALOTHECIUM Br. & Sch. Bryol. Eur. fasc. 46-47.
1851.

This genus is so closely allied to *Camptothecium* that it is clearly a violation of natural relationships to put it in another family. The nearly erect and symmetric capsule and the incomplete peristome are the only characters associating *Homalothecium* with the Isotheciaceae.

ISOTHECIUM Brid. Bryol. Univ. 2: 355, pl. 10. 1827.

Schimper, Synopsis, Ed. 2: 662, separates *Isothecium myosuroides* (L.) Brid. from the genus of which *I. myurum* (Pollich) Brid. remains the type. *I. myosuroides* clearly belongs to the Brachytheciaceae and all our American species are closely allied to it. Thus we have no American species of *Isothecium*.

BRACHYTHECIACEAE.

My studies in this family have been confined principally to the following genus.

BRACHYTHECIUM Br. & Sch. Bryol. Eur. Fasc. 52-54.
1853.

Gametophyte generally large, never minute, prostrate or creeping, irregularly or subpinnately branching. Branch leaves pluri-seriate, acute to long-acuminate, usually concave, longitudinally plicate or sulcate; vein extending to the middle or beyond; median leaf-cells linear to linear-rhomboidal, length 5-15 times diameter (3-5:1 in *B. reflexum*); basal cells broader and shorter, alar quadrate. Stem leaves larger and broader; paraphyllia none. Male branches gemmiform. *Sporophyte* with seta smooth to very rough, twisted to the right. Calyptra cucullate, smooth; capsule short, 2-4:1, inclined, arcuate (erect and symmetric in *B. Utahense*, *B. acuminatum*, *B. splendens* and *B. biventrosus*); more or less contracted under the mouth when dry; operculum convex-conic

to very short-rostrate; columella persistent; peristome double; the teeth united at the base, linear-lanceolate, slender pointed, closely and regularly articulate, with a very distinct median line, darker colored and marked with very fine transverse lines below, above lighter and granulose-roughened. Segments lanceolate, attached to a wide basal membrane, more or less split along the keel, granulose-roughened above, usually brownish yellow; cilia two or three, well developed, nodose or appendiculate (except in the four species mentioned above). Spores some shade of brown, nearly smooth to very finely roughened.

The roughening of the spores and the transverse lines on the peristomal teeth are so fine that a magnification of 300-400 diameters is required to bring out these points well.

The genus can be divided into six fairly distinct groups.

I. *Salebrosus* group including *B. salebrosus*, *B. flexicaule*, *B. campestre*, *B. Roteanum*, *B. acutum*, *B. oxycladon*, *B. albicans*, *B. pseudo-collinum* and *B. turgidum*.

II. *Rutabulum* group including *B. rutabulum*, *B. asperrimum*, *B. lamprochryseum* and *B. rivulare*.

III. *Acuminatum* group including *B. acuminatum*, *B. splendens*, *B. biventrosus* and *B. cyrtophyllum*.

IV. *Plumosus* group including *B. plumosus*, *B. populeum* and *B. digastrum*.

V. *Reflexus* group including *B. reflexus*, *B. glaciale*, *B. Starkei* and *B. Novae-Angliae*.

VI. *Velutinum* group including *B. velutinum*, *B. Leibergii*, *B. Idahense*, *B. sub-erythrorrhizon*, *B. collinum*, *B. Utahense*, *B. erythrorrhizon* and *B. Bolanderi*.

I. Costa extending into apex.

Seta very rough throughout.

Plants very slender; leaf-cells 3-5:1

21. *B. reflexus*.

Plants more robust; leaf-cells 8-10:1.

22. *B. glaciale*.

Seta nearly smooth at base; leaf-cells 5-8:1.

19. *B. populeum*.

II. Costa extending $\frac{1}{2}$ - $\frac{2}{3}$ length of leaf.

I. Branch leaves entire.*

Branch leaves long-filiform acuminate.

Slender, dioicous.

7. *B. albicans*.

Very stout, monoicous.

9. *B. turgidum*.

Branch leaves narrowly acute to acuminate.

18. *B. plumosus*.

*The branch leaves of *B. acutum* are often entire.

2. Branch leaves serrate.

A. Seta smooth.

a. Capsule erect and symmetric.*

Synoicous.

30. *B. Utahense*.

Dioicous.

Cilia single.

15. *B. splendens*.

Cilia rudimentary or wanting.

Plants slender; leaves gradually slender pointed.

16. *B. biventreosum*.

Plants more robust; leaves acuminate.

14. *B. acuminatum*.

b. Capsules unsymmetric, more or less inclined.

† Capsules 3-4: 1, suberect.

Monoicous; enlarged basal cells very numerous and conspicuous.

4. *B. Roteanum*.

Dioicous; only a few basal cells enlarged.

6. *B. oxycladon*.

†† Capsules 2-3:1, strongly inclined or horizontal.†

*Stem leaves gradually narrowed from base to slender apex.

Plants robust; leaves at least 1.8 mm. long.

Stem leaves lanceolate, 0.6 mm. broad.

2. *B. flexicaule*.

Stem leaves triangular-ovate, 1 mm. broad.

5. *B. acutum*.

Plants slender; branch leaves not more than 1.5 mm. long.

8. *B. pseudo-collinum*.

** Stem leaves acuminate.

Dioicous.

31. *B. erythrorrhizon*.

Monoicous.

Branch leaves at least 1.8 mm. long.

1. *B. salebrosum*.

Branch leaves not more than 1.2 mm. long.

Stem leaves broadly ovate.

20. *B. digastrum*.

Stem leaves narrowly ovate to ovate-lanceolate.

Branch leaves oblong-lanceolate, 1-1.2 mm. long.

28. *B. suberythrorrhizon*.

Branch leaves ovate-lanceolate, less than 1 mm. long.

—— gradually acuminate. 26. *B. Idahense*.—— abruptly acuminate. 29. *B. collinum*.

B. Seta slightly roughened with small distant papillae.

Stems short, irregularly branching; monoicous.

29. *B. collinum*.Stems long and slender, pinnately branching; dioicous. 31. *B. erythrorrhizon Thedenii*.

C. Seta rough above, nearly smooth below.

Leaves plicate, long acuminate.

3. *B. campestre*.

Leaves not plicate, shorter acuminate.

18. *B. plumosum*.

D. Seta rough throughout, with large crowded papillae.

Cells of branch leaves 5:1, unipapillate.

24. *B. Novae-Angliae*.

Cells of branch leaves at least 8:1, smooth.

Secondary stems dendroid; leaves ovate and very short-acuminate.

13. *B. rivulare*.**B. cyrtophyllum* belongs here.† Capsules of *B. flexicaule* are sometimes 3-4:1.

Not dendroid; leaves slender pointed.*

Stem leaves lanceolate.

25. *B. velutinum*.

Stem leaves ovate to triangular-ovate.

Monoicous.

Cilia not appendiculate; plants robust, yellow green.

10. *B. rutabulum*.

Cilia appendiculate; less robust, green.

Stem leaves narrowly ovate. 26. *B. Leibergii*.

Stem leaves broadly ovate. 23. *B. Starkei*.

Dioicous.

Leaves 0.6–0.8 mm. long.

32. *B. Bolanderi*.

Leaves at least 1.2 mm. long.

Branch leaves decurrent, strongly serrate.

11. *B. asperinum*.

Branch leaves not decurrent, merely denticulate.

12. *B. lamprochryseum*.

I. BRACHYTHECIUM SALEBROSUM (Hoffm.) Br. & Sch. Bryol. Eur.
fasc. 52–54. pl. 549. 1853.

Hypnum salebrosum Hoffm. Deutschl. Fl. 2: 74. 1795.

Hypnum plumosum salebrosum C. Muell. Syn. 2: 359. 1851.

Brachythecium laevisetum Kindb. Bull. Torr. Club, 17: 279.
1890.

Gametophyte in wide glossy yellow-green mats; stems 5 cm. or more long, creeping and radiculose, irregularly to subpinnately branching; branches terete-foliate or seldom complanate-foliate; branch leaves lanceolate, 1.8–2.3 × 0.5–0.65 mm., long-acuminate, serrate above, very concave, bisulcate; costa extending beyond the middle; median cells linear-vermicular, 10:1; basal cells much shorter and broader; alar quadrate, thin walled; stem leaves ovate-lanceolate, nearly entire, 2–2.5 by 0.8–1.1 mm.: monoicous; male branches gemmiform, borne on the stem; perigonal leaves ovate-lanceolate, acuminate; antheridia oblong-clavate, sessile: perichaetium 2 mm. long; the leaves sheathing at base with spreading points; the inner rather abruptly narrowed into a long filiform acumination, entire or distantly serrate above, costa nearly obsolete.

Sporophyte 1–2 cm. high; seta red-brown, smooth; capsule red-brown, 2.5–3 mm. long, 2.5–3:1, oblong-ovoid, usually

* *B. lamprochryseum* sometimes assumes a dendroid habit.

strongly arcuate and horizontal; operculum conic-apiculate; annulus very narrow and inconspicuous, often remaining attached to the operculum; teeth of peristome red-brown below; segments nearly as long as the teeth; cilia 2, well developed, nodose or subappendiculate; spores nearly smooth, 15μ , maturing in autumn or early winter.

Type locality European.

On earth, stones, roots and trunks of trees, and rotting wood in woods and moist shady places. Eastern Canada and northern and eastern United States; rarely found west of Minnesota and Nebraska; south to North Carolina; Montana (Dr. F. W. Anderson, R. S. Williams); Idaho (Leiberg); Green Lake and Fraser River (Macoun). Not rare.

ILLUSTRATIONS.—Br. & Sch. l. c.; Lesq. & James, Mosses of North America. *pl.* 5; Husnot, Musc. Gall. *pl.* 93; Rab. Krypt. Fl. 4³, *f.* 364.

EXSICCATI.—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 328, (Ed. 2) 487; Austin, Musc. Appal. 312 and 313; Macoun, Can. Musc. 283, 438 (*Hypnum acutum*).

Distinguished from *B. oxycladon*, which it closely resembles, by being monoicous; by the shorter and more curved capsules and the more distant and open leaves, having a looser basal areolation; branch leaves also more slender pointed. The capsules are very variable in length, sometimes almost exactly resembling those of *B. oxycladon*. An extremely variable species as at present understood.

Authentic specimens of *B. laevisetum* Kindb. from the type locality have been examined and no characters could be found to differentiate it from *B. salebrosum*.

A great variation in the appearance of the dried specimens appear to be due to the conditions of drying. Herbarium specimens with the leaves widely spreading and somewhat complanate, upon being wet and dried again took on the appearance that is characteristic of the species, the branches becoming terete-foliate and the leaves much more closely appressed.

1a. BRACHYTHECIUM SALEBROSUM FLACCIDUM Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 550. 1853.

Gametophyte in wide loose dark green mats; stem and branches slender; branch leaves distant, spreading, more or less complanate,

strongly serrate, apex often twisted; stem leaves very broadly triangular-ovate approaching in outline those of *B. Starkei*, about 2×1.2 mm., very slenderly acuminate, slightly serrulate. *Sporophyte* with cilia often 3. Capsule much like that of *B. oxycladon*.

New Brunswick (Fowler); Weehawken, N. J., and Oneida, N. Y. (Austin). *B. salebrosum flaccidum* is the extreme broad-leaved form of the species and may be distinct, but at present our knowledge is insufficient to define it.

2. BRACHYTHECIUM FLEXICAULE R. & C. n. sp.

Gametophyte in wide loosely intricate mats, yellow-green, often brown underneath; stems creeping, densely radiculose, closely applied to the substratum, 5–12 cm. long, pinnately branching; branches 5–10 mm. long, terete-foliate, ascending, attenuate; branch leaves narrowly lanceolate, $2-2.5 \times 0.5-0.65$ mm., gradually narrowed to a very long slender apex, serrate, concave or bisulcate; margins somewhat reflexed; costa extending $\frac{1}{2}-\frac{2}{3}$ length of leaf; median cells linear-vermicular, 12–14:1; basal cells broader and shorter; extreme alar cells subquadrate: monoicous. *Sporophyte* usually not to be distinguished from that of *B. salebrosum*; capsule sometimes approaching that of *B. oxycladon*, 3–4:1.

Type locality, John's Beach, Newfoundland (Waghorne); on earth, Revelstoke, B. C. (Macoun, sent out as *B. glareosum*); on schistose rocks, Manchester, Vt. (A. J. G.); New Jersey (Austin); on decaying wood, Bradford, Pa. (Burnett); Adirondacks (Mrs. Annie M. Smith).

Type seen.

This species seems to me to be almost identical with *B. salebrosum densum* Br. & Sch. Bryol. Eur. *pl.* 550, but M. Cardot thinks otherwise. It is easily distinguished from all its near allies by the extremely narrow stem leaves, gradually narrowed from just above the base to the apex.

3. BRACHYTHECIUM CAMPESTRE Br. & Sch. Bryol. Eur. fasc. 52–54. *pl.* 11. 1853.

Hypnum rutabulum campestre C. Muell. Syn. 2: 368. 1851.

Brachythecium subalbicans De Not. Cronaca, 2: 20. 1867. Epil. 118. 1868.

Gametophyte in wide loose glossy yellow-green mats; stems 5 cm. or more long, decumbent or ascending, often stoloniferous at the ends, subpinnately branching; branches 5–10 mm. long; branch leaves equally spreading to somewhat falcate-secund, lanceolate to ovate-lanceolate, $1.4-2 \times 0.4-0.6$ mm. long-acuminate, strongly serrate above, concave, costate to the middle or beyond; median cells linear-vermicular 10–12:1; basal cells shorter and broader; alar quadrate; stem leaves ovate-lanceolate, less strongly serrate, long subfiliform acuminate, $2 \times 0.6-1.1$ mm., strongly plicate: monoicous; male branches borne on the stem, gemmiform; antheridia oblong-cylindric; paraphyses very long and numerous; perigonial leaves ovate, acuminate: perichaetium 2–2.5 mm. long; leaves sheathing at base, with squarrose points; inner leaves oblong-lanceolate, rather abruptly narrowed into a long filiform serrate acumination, costate. *Sporophyte* 1–2 cm. high; seta red when young, red-brown when old, more or less roughened with rather low distinct papillae, nearly smooth below; capsule red-brown, 2.5–3 mm., 3:1, unsymmetric and inclined; operculum long-conic, apiculate; annulus narrow, usually adhering to the operculum; cilia 1 or 2, long, nodose and papillose-roughened; spores roughened, 15μ , maturing in autumn.

Type locality European.

On damp earth and stones, in woods and in damp grassy places. Apparently has the range of *B. salebrosum*. As yet no specimens have been reported from farther south than New Jersey. Quesnell, B. C. (Macoun).

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, Musc. Gall. *pl.* 92.

EXSICCATI.—Aust. Musc. Appal. 314–315.

Scarcely to be distinguished from *B. salebrosum* except by the slightly scabrous seta, rather longer capsule and longer acuminate leaves. There are all grades of roughness of seta and it is doubtful if this species is more than a variety of *B. salebrosum*. *B. oxycladon*, *B. flexicaule*, *B. salebrosum*, *B. acutum* and *B. campestre* grade into each other and are difficult to separate satisfactorily.

4. *BRACHYTHECIUM ROTEANUM* DeNot. Cronaca, 2: 19. 1867;
Epil. 117. 1869.

Brachythecium salebrosum var. *cylindricum* Br. & Sch. Bryol. Eur. fasc. 52–54. *pl.* 550. 1853.

Brachythecium salebrosum Texanum Aust. Bull. Torr. Club, 6: 44. 1875.

Gametophyte in glossy yellow-green mats; stems creeping, subpinnately branching; branches subjulaceous, 5–12 mm. long, terete-foliate; branch leaves more closely imbricated and appressed than in *B. salebrosum*, ovate-lanceolate, long acuminate, $1.5-2 \times 0.45-0.55$ mm., serrate above, concave, often bisulcate with reflexed margins; costa extending $\frac{1}{2}$ to $\frac{2}{3}$ length of leaf; median cells linear-fusiform, $10-12:1$; several rows of basal cells much enlarged, quadrate to oblong-hexagonal; lower stem leaves ovate, abruptly narrowed to a long slender acumination, nearly entire, $2-2.4 \times 0.9$ mm.; areolation much looser; upper stem leaves approaching branch leaves in size and shape: monoicous; male branches gemmiform; inner perigonal leaves ovate, very long-acuminate, entire, ecostate; paraphyses stout, nearly twice the length of the cylindric short-stipitate antheridia: perichaetium 2.25 mm. long; leaves sheathing at base with spreading points; inner oblong-ovate, long acuminate, nearly ecostate and entire. *Sporophyte* 2.5 cm. high; seta red-brown, smooth; capsule red-brown, cylindric, nearly erect, slightly arcuate, about 3 mm. long, $4:1$; operculum conic-rostrate; annulus (?), cilia 2 or 3, well developed, nodulose; spores granulose roughened, 13μ .

Type locality European.

Dallas, Texas (J. Boll); La., Drumm. Musc. Am. (S. States), 123 "*Hypnum laetum* var?"

Distinguished from *B. oxycladon* by being monoicous and by the conspicuously enlarged basal cells of the leaves; from *B. salebrosum* by the longer suberect capsule and leaves scarcely or not at all plicate; from both by its much shorter-acuminate perichaetial leaves. The American form here described is clearly distinct from either *B. salebrosum* or *B. oxycladon*, and is referred to *B. Roteanum* on the authority of C. Mueller, who identified a specimen of Boll's collection now in the Columbia Herbarium as *B. salebrosum cylindricum* Br. & Sch. I have not had authentic European material for comparison but the plant described answers very closely indeed to Limpricht's description of *B. Roteanum* (Rab. Krypt. Fl. 4³: 72.) The specimen Austin described was from the same locality and collector as the specimen identified by Mueller.

5. BRACHYTHECIUM ACUTUM (Mitt.) Sull. Icon. Musc. Suppl. 99.
pl. 75. 1874.

Hypnum acutum Mitt. Journ. Linn. Soc. 8: 33. *pl.* 6.

Brachythecium mammilligerum Kindb. Macoun, Cat. Can. Pl. 6:
 192. 1792.

Gametophyte in wide thin glossy-green to yellowish-green mats; stems prostrate, creeping or sometimes floating, 5–10 cm. long, irregularly divided, radiculose at base, branching irregularly pinnatifid; branches few, 5–10 mm. long, frequently somewhat complanate-foliate, not radiculose; branch leaves distant, open, lanceolate to ovate-lanceolate, gradually narrowed from just above the base, ending in a very slender point, $1.6-2 \times 0.5-0.7$ mm., distantly serrate or entire, very slightly concave, little or not at all plicate; costa extending two-thirds the length of the leaf; median cells linear-vermicular, 10:1; basal and alar cells shorter and broader, oblong-rhomboidal to quadrate; stem leaves slender pointed, triangular-ovate, nearly entire, 2–2.5 by 1 mm.: monocious, sometimes polygamous; perigonal leaves ovate-acuminate, bordered by a row of elongated cells: perichaetium 2.5 mm. long; the inner leaves ovate-lanceolate, sheathing at base, open above, abruptly long-filiform acuminate, ecostate. *Sporophyte* 2.5–3.5 cm. high; seta smooth, red-brown, often lighter colored above; capsule red-brown, oblong-ovoid to short cylindric, 3 mm. long, 3:1, arcuate and inclined, occasionally nearly symmetric; operculum long conic, apiculate; annulus simple, of 1 or 2 rows of cells; teeth of peristome subulate-lanceolate, orange; segments nearly as long as teeth; cilia 2 or 3, well developed, strongly nodose or appendiculate; spores minutely roughened, $13-15\mu$, maturing in autumn.

Type seen, from Pack River, British Columbia (Lyall) in Mitten herbarium. On the ground and rotting logs and in moist and swampy places. Northern United States and Canada, across the continent; south to N. J., Ohio and Colorado. Macoun, Can. Cryptogams 110 (*B. salebrosum mammilligerum*).

ILLUSTRATIONS.—Mitt. l. c.; Sull. l. c.

EXSICCATI.—Austin, Musc. Appal. 316.

A careful comparison of a large number of specimens indicates

that this species is distinct from the European *B. Mildeanum* Sch. The aspect of the plant is different in that it has loosely foliate and rather flaccid branches, while *B. Mildeanum* has more robust, densely foliate, turgid branches. The leaves are long, slender-pointed, more like *B. glareosum* than *B. Mildeanum*. Sullivant's figure resembles *B. Mildeanum* more closely than *B. acutum*. Mitten's figure represents the leaf much more accurately. Austin's Musc. Appal. 316, is, however, more like *B. Mildeanum* and Sullivant's figure and may prove to be distinct. There seems to be a complete series of intergradations between this species and *B. salebrosum*. The gradually tapering stem leaves which are seldom plicate and the more slender-pointed and less serrate branch leaves are the characters most easily recognized.

6. *BRACHYTHECIUM OXYCLADON* (Brid.). Jaeg. & Sauer. St. Gall. Nat. Gesell. 1877-1878 : 323.

Hypnum oxycladon Brid. Musc. Recent. Suppl. 2: 123. 1812.

Hypnum laetum Brid. Bryol. Univ. 2: 479. 1827.

Hypnum luteolum C. Muell. Syn. 2: 357. 1851.

Brachythecium laetum Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 554. 1853.

Brachythecium spurio-acuminatum C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 191. 1892.

Gametophyte in wide glossy yellow-green intricate mats ; stems prostrate, irregularly divided, pinnately branching ; branches unequal, 0.5-2.5 cm. long, attenuate at ends ; upper branch leaves erect-open, ovate-lanceolate, slightly decurrent, $1.5-2 \times 0.45-0.8$ mm., acute to slenderly acuminate, apex often slightly twisted, serrulate nearly all around, concave, plicate, upper margins often slightly recurved ; costa extending beyond the middle ; median cells narrowly linear, 10: 1 ; areolation gradually becoming shorter and broader toward the base ; alar cells quadrate ; stem leaves larger, $2-2.5 \times 0.9-1.2$ mm., often nearly entire, more deeply plicate : dioicous or rarely monoicous ; male branches gemmiform, borne on the stem ; antheridia oblong to obovoid ; paraphyses numerous, stout, longer than antheridia ; inner perigonal leaves ovate to oblong-ovate, acuminate, ecostate, loosely areolate : perichaetium 2-2.5 mm. long ; leaves sheathing at base ; the inner

with spreading points, oblong-lanceolate, abruptly narrowed to a long filiform acumination, nearly entire or somewhat serrulate above, costa thin or wanting. *Sporophyte* 1.5–2.5 cm. high; seta red-brown, smooth; capsule red-brown, oblong-cylindric, suberect, slightly arcuate, somewhat contracted below the mouth when dry, the neck gradually narrowed to the seta, 2.5–3.5 mm. long, about 4 : 1; operculum long conic to conic-rostrate; annulus none; teeth of peristome light red-brown, rather abruptly narrowed to a slender hyaline point; segments from a broad basal membrane, nearly as long as the teeth; cilia two, strongly nodose or appendiculate; spores finely papillose-roughened, about 15μ , maturing in autumn or early winter.

Type locality, Penn. (Ludwig).

On earth rocks, and roots of trees in woods. Northeastern United States and eastern Canada; west to Minnesota, Kansas and Nebraska; Colorado (Brandeggee); south to North Carolina and Tennessee; Missouri (Bush). Apparently common.

EXSICCATI.—As *H. laetum* Drumm. Musc. Am. (S. States), 122; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 329, (Ed. 2) 488, 489, 490; Austin Musc. Appal. 309; Macoun, Can. Musc. 281, 566 (*B. spurio-acuminatum*); Ren. & Card. Musc. Am. Sept. Exsic. 104, (*B. biventrosus*).

ILLUSTRATIONS.—Br. & Sch. l. c.; Sull. Icon. Musc. *pl.* 115; Husnot, Musc. Gall. *pl.* 93; Rab. Krypt. Fl. 4³ : f. 374.

Type specimens of both *B. oxycladon* and *B. laetum* have been examined. The branch leaves of the former are less serrate than those of the latter but the acumination and serration of the leaves varies so much even on the same plant, that these characters alone cannot be used even to separate varieties. The species is exceedingly variable and difficult to separate from its allies, especially *B. salebrosum*; the difficulty is increased by the fact that the species is very imperfectly dioicous.

Examination has been made of authentic specimens of *B. laetum* var. *fallax* R. & C. (Bot. Centralbl. 44 : 422. 1890), *B. laetum* var. *pseudo-acuminatum* R. & C. l. c.; *B. laetum* Roelli R. & C. l. c., from type locality and from Herb. Cardot. The variety *fallax* seems to be nothing more than a local form with nar-

rower leaves and a more dirty green color; var. *pseudo-acuminatum* is a dwarfed and more caespitose plant, but differs in no essential particular from the ordinary form of *B. oxycladon* except, perhaps, in the more slender pointed branch leaves. Var. *Roellii* is not at all like *B. laetum*, having short julaceous branches and ovate to ovate-lanceolate leaves of about $\frac{1}{2}$ the size of the leaves of *B. laetum*. All of these varieties were sterile and the species in the *salebrosum* group of *Brachythecium* are too closely related to make valid varieties from sterile specimens.

Renauld & Cardot's 104 differs in no essential respect from the ordinary *B. oxycladon* but as compared with the type of *B. biventrosus* it is larger and stouter; leaves broader and less slender pointed, basal areolation that of *B. oxycladon*. I am unable to agree with the opinion expressed by M. Cardot in *Hedwigia* 35: 308. 310. 1896. M. Cardot tells me that he has not seen type specimens of *B. biventrosus* C. Muell. The specimens communicated by Lesquereux could not have been this species or he would not have confused it with *B. laetum*. *B. biventrosus* is very closely related to *B. acuminatum* as is indicated by the erect capsule, imperfect peristome and general appearance. Specimens of *B. digastrum* of the type collection are very distinct from *B. oxycladon* and are most closely allied to the *plumosum* group as is indicated by the leaf characters and general appearance.

6a. BRACHYTHECIUM OXYCLADON DENTATUM (L. & J.).

Hypnum laetum dentatum L. & J. Mosses of North America 335. 1884.

Brachythecium Sullivantii Br. & Sch. Bryol. Eur. fasc. 52-54: 21. 1853.

Gametophyte often submerged and dirty brownish green below; stems and branches slender, stem leaves broader and shorter, acute to acuminate, serrulate; branch leaves shorter pointed and more strongly serrate, more loosely areolate at base. Seta 3-3.5 cm. long, very slightly roughened at base; operculum short-rostrate; apparently growing in wet places and rocks on earth.

In woods near, and on the banks of the Hackensack River, Closter, N. J. (Austin); on ground in ravines, Louisiana (Langlois); banks of a creek, Saline Co., Missouri (Rev. C. H. Demetrio); swamp, Monkton, Vt. (C. G. Pringle).

EXSICCATI.—Sull. Musc. Allegh. 43, in part only.

7. *BRACHYTHECIUM ALBICANS* (Neck.) Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 553. 1853.

Hypnum sericeum gracile albicans Dill. Hist. Musc. 328. *pl.* 42 f. 63. 1741.

Hypnum albicans Neck. Meth. Musc. no. 36. 1771; also Hedw. Descr. et Adumb. 4: 13. *pl.* 5. 1793.

Hypnum flavescens Roth. Fl. Germ. 3: 303. 1800.

Brachythecium pseudo-albicans Kindb. Bull. Torr. Bot. Club, 17: 278. 1890.

Gametophyte in rather loose glossy light-green mats; stems decumbent or ascending, much divided, irregularly branching, slightly radiculose; branches erect or ascending, terete-foliate, slender, 5-15 mm. long; branch leaves decurrent, appressed-imbricate when dry, ovate-lanceolate, smaller and narrower toward the end of the branches, $1.6-2.2 \times 0.5$ to 0.7 mm., long and slenderly acuminate, entire or rarely slightly denticulate, concave or bisulcate; margins more or less reflexed; costa extending beyond the middle; median cells linear-fusiform, 5-8:1; basal broader and shorter; quadrate alar cells numerous; stem leaves broader, 0.6-1 mm. wide, more abruptly narrowed to the slender acumination: dioicous; perichaetium 2.5 mm. long; the leaves with loosely sheathing bases and spreading points; inner leaves exceedingly long filiform acuminate from an oblong base, nearly entire, costa extending nearly through the body of the leaf. *Sporophyte* 12-20 mm. high, sometimes 2 from 1 perichaetium; seta smooth, red-brown; capsule red-brown, ovoid, 2 mm. long, 2:1, unsymmetric, inclined or horizontal, little or not at all contracted under the mouth when dry; operculum convex-conic; annulus of 2 rows of cells, persistent; teeth of peristome linear-lanceolate, yellow brown; segments somewhat shorter than the teeth; cilia 2 or 3, appendiculate; spores finely roughened, $14-18\mu$; rarely fruiting.

Type locality European.

On rocks and in dry sandy or grassy places. Rocky Mountains and westward in northern United States and Canada; Agattu, Id. Behring Sea, U. S. S. Albatross; Greenland (Fl. Gr.).

ILLUSTRATIONS.—Dill. l. c.; Br. & Sch. l. c.; Hedw. l. c.; Husnot, Musc. Gall. *pl.* 93.

EXSICCATI.—Macoun, Can. Musc. 285.

Distinguished from *B. salebrosum*, *B. acutum* and other closely allied species by being dioicous and by its very slender pointed and entire leaves. *B. glareosum* which has not yet been found in America is also dioicous but is much more robust and its slender pointed leaves are strongly serrate. *B. pseudo-albicans* Kindb. from the type collection, is a form with leaves rather shorter acuminate, occasionally bearing a very few inconspicuous teeth and with a rather larger number of quadrate alar cells. The leaves, however, are not more denticulate than is sometimes the case with European specimens.

7a. BRACHYTHECIUM ALBICANS OCCIDENTALE R. & C. Bot. Centralbl. 44: 422. 1890.

More slender, more loosely foliate; leaves subsecund, shorter acuminate, denticulate. Montana (Röll.)

8. BRACHYTHECIUM PSEUDO-COLLINUM Kindb. Macoun, Cat. Can. Pl. 6. 196. 1892.

Gametophyte in loosely intricate, dark green mats; stems creeping, subpinnately branching, radiculose; branches about 5 mm. long, terete-foliate, branch leaves erect-spreading, $1-1.2 \times 0.3-0.4$ mm., very slightly decurrent, lanceolate, concave, serrate; margins reflexed at base; costa extending to middle; apex acute, slender, twisted; median cells linear, $8-10:1$; basal shorter and broader, alar quadrate; stem leaves ovate-lanceolate, more loosely areolate, less strongly serrate, slightly bisulcate, $1.4-1.6 \times 0.6$ mm.: monioicous; perichaetium about 2 mm. long, sheathing; inner leaves ovate-lanceolate, costate, rather abruptly narrowed to a long filiform acumination, nearly entire, very loosely areolate, leaf-cells $130 \times 23\mu$. *Sporophyte*, 15 mm. high; seta smooth, red-brown; capsule brown, ovoid-cylindric, 2 mm. long, $2-2.5:1$, slightly unsymmetric, suberect; operculum long conic, annulus lacking; segments as long as the teeth; cilia well developed, 1 or 2, strongly nodose or subappendiculate; spores 16μ , strongly papillose.

Type locality under a well platform, Canaan Forks, N. B. (J. Moser); type seen. Also collected at Closter, N. J. (Austin).

Sporophyte strongly resembling *B. collinum* but the gametophyte is entirely different in its microscopic characters.

9. BRACHYTHECIUM TURGIDUM (Hartm.) C. Hartm. Kindb. Enum. 294. 1888.

Hypnum turgidum Hartm. Skand. Fl. Ed. 5: 328. 1849.

Hypnum plumosum turgidum Lindb. Musc. Scand. 36. 1879.

Gametophyte in glossy, whitish-green to golden-green tufts; stems creeping, irregularly branching; branches very stout and turgid, julaceous, pointed, sometimes ending in flagellae, 1–3 cm. long; leaves loosely appressed imbricate, somewhat decurrent, lanceolate to broadly ovate-lanceolate, $2.5-3.5 \times 0.9-1.2$ mm., entire, gradually narrowed to a long filiform acumination, strongly plicate, costate to middle; margins reflexed below; median leaf-cells 12–15:1; basal broader and shorter; alar rhomboid-quadrate; stem and branch leaves little different: monoicous; perigonial leaves entire, sharply acuminate, ecostate; antheridia short-stipitate: perichaetial leaves sheathing, long-acuminate, entire, ecostate. *Sporophyte* 1–2 cm. high; seta red-brown, smooth, twisted to the right below to the left above; capsule 3–3.5 mm. long, 3:1, sub-horizontal, curved, somewhat contracted under the mouth when dry; operculum conic; annulus of one row of cells; cilia one or two, nodose; spores $18-24\mu$, nearly smooth, maturing in autumn.

Type locality European.

In alpine or boreal regions in grassy or stony places. Battle Harbor, Labrador (Waghorne); Stephen, Rocky Mts. (Macoun); Greenland (Fl. Gr.). This species has much the appearance of *B. glareosum* but differs in its more turgid branches, entire leaves and in being monoicous. Not yet found fruiting in America. The description of the sporophyte is adapted from Limpricht.

10. BRACHYTHECIUM RUTABULUM (L.) Br. & Sch. Bryol. Eur. fasc. 52–54, pl. 543 and 544. 1853.

Hypnum rutabulum L. Sp. Pl. 1124. 1753.

Hypnum dentatum var. *vul. latissimum operculis obtusis*. Dill. Hist. Musc. 295. pl. 38. f. 29. 1741.

Brachythecium leucoglaucum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 198. 1892.

Gametophyte robust, in wide, loose mats, glossy yellow-green; stems decumbent, arcuate, 5–10 cm. long, stoloniferous at the ends, irregularly divided, subpinnately branching; branches erect or ascending, 1–2 cm. long, gradually attenuate, terete-foliate to somewhat complanate-foliate; branch leaves loosely erect-spreading, ovate-lanceolate, very slightly decurrent, $1.5-2 \times 0.5-0.7$ mm., gradually long-acuminate, distantly serrate, slightly concave, scarcely plicate; costa extending $\frac{2}{3}$ length of leaf, sometimes toothed on the back above; median cells linear, 15 : 1; basal cells little differentiated, somewhat shorter; stem leaves broadly ovate, more abruptly acuminate, $2-3 \times 1-1.5$ mm., less strongly serrate; basal leaf cells conspicuously broader and shorter; a few of the cells at the extreme angles enlarged and inflated: monoicous or rarely polygamous; male branches frequent, cylindric, more or less curved; perigonal leaves ovate-lanceolate, gradually long-acuminate, denticulate above: perichaetium about 3 mm. long; leaves sheathing at base with squarrose points; the inner oblong-ovate, rather abruptly narrowed to a very long filiform acumination, denticulate above, ecostate, the outer leaves often short costate. *Sporophyte* 2–3 cm. high; seta red-brown, very rough throughout; capsule red-brown, oblong, arcuate and horizontal, not contracted under the mouth when dry, 2.5–3.5 mm. long, about 1 mm. thick; operculum long-conic, apiculate to subrostellate; annulus of two rows of cells, persistent; teeth of peristome red-brown, margined, stout; segments nearly as long as the teeth; cilia 2 or 3, nodose, some often imperfectly developed; spores roughened, $13-16\mu$, maturing in winter.

Type locality European.

On the ground and stones in wet places, less frequently on roots and stems of trees and decaying logs. Northern United States and Canada; south to New Jersey and Pennsylvania. Columbia Falls, Montana (R. S. Williams).

ILLUSTRATIONS.—Hedw. Descr. 4: *pl.* 12; Br. & Sch. l. c.; Wils. Bryol. Brit. *pl.* 26; Husnot, Musc. Gall. *pl.* 92.

EXSICCATI.—Sull. Musc. Allegh. 45; Sull. & Lesq. Musc.

Bor. Am. (Ed. 1) 331, (Ed. 2) 494 and 495 ; Austin, Musc. Appal. 318 ; Ren. & Card. Musc. Am. Sept. Exsic. 243.

Quite variable in size and shape of leaves and in gross appearance. Macoun's Can. Musc. 591 on which *B. leucoglaucum* C. Muell & Kindb. was founded has the seta very rough and cannot be distinguished from this species.

10a. *BRACHYTHECIUM RUTABULUM FLAVESCENS* (Brid.) Br. and Sch.
Bryol. Eur. fasc. 52-54. *pl.* 544.

Hypnum flavescens Brid. Spec. Musc. h. f. 185. 1812.

Brachythecium platycladum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 195. 1892. Can. Musc. 287, in part.

Plants straw-colored, very stout ; stem and branches loosely foliate, turgid ; stem leaves very broadly ovate, concave, abruptly short-acuminate. With the typical form. Montana (R. S. Williams) ; Jamaica Plains, Mass. (E. Faxon).

At first sight this form seems distinct from *B. rutabulum* but there is a complete gradation of forms from the typical plant to the variety. The stem leaves often resemble those of *B. rivulare* but they are longer acuminate and some of the branch leaves are not much different from those of typical *B. rutabulum*.

This variety seems imperfectly dioicous, as both Kindberg and R. S. Williams describe it as dioicous. The Columbia specimen of Macoun's 287 (which is undoubtedly the same as that described by Kindberg) contained plants which bore both male and female branches.

11. *BRACHYTHECIUM ASPERRIMUM* Mitt. Journ. Linn. Soc. 8: 33.
1865.

Hypnum vallium Sull. & Lesq. Musc. Bor. Am. Ed. 2, 506.
1865.

Brachythecium Villardi R. & C. Bot. Centralbl. 44: 442. 1890.

Brachythecium gemmascens C. Muell. & Kindb. Macoun, Cat. Can. Pl. 195. 1892.

Brachythecium spurio-rutabulum C. M. & Kindb. l. c. 197.

Brachythecium Columbico-rutabulum Kindb. l. c. 198.

Brachythecium subintricatum Kindb. Rev. Bryol. 22: 86. 1895.

Gametophyte in wide loose mats, yellow-green ; stems 5-11 cm. long, decumbent or ascending and arcuate, stoloniferous at the

ends, sparingly radiculose, pinnately branching; branches 5–15 mm. long, attenuate at the ends, terete-foliate; branch leaves rather distant, erect-open, long decurrent, ovate-lanceolate, gradually long and narrowly acuminate, strongly serrate above, somewhat concave and plicate, $1.6 \times 0.45\text{--}0.6$ mm., costate to beyond the middle; median cells linear, 10–15: 1; basal and alar cells little differentiated, somewhat shorter and broader; stem leaves varying from broadly ovate and rather abruptly acuminate to elongated triangular-ovate and gradually long and slenderly acuminate, strongly plicate and decurrent, less strongly serrate, often nearly entire, basal cells more differentiated: dioicous; male plants smaller and more slender; leaves more distant and narrower; antheridial branches large, subglobose; antheridia numerous, large; inner perigonal leaves ovate, abruptly long-acuminate, bordered below by a row of elongated cells, nearly ecostate; the outer obovate and costate: perichaetium 2.5 mm. long; the leaves with sheathing bases and squarrose recurved points; inner leaves oblong-ovate, rather abruptly long filiform-acuminate, costate. *Sporophyte* 2–4.5 cm. high; seta red-brown, very strongly papillose; capsule red-brown, 2.5 mm. long, 2.5–3: 1, oblong-ovoid, arcuate and horizontal, somewhat contracted under the mouth when dry and empty; operculum conic-apiculate; annulus present; cilia 2 or 3, strongly nodose; spores roughened, $13\text{--}20\mu$, maturing in early winter.

Type locality, British Columbia (Lyall and Douglas.)

On moist rocks and soil. California, Idaho, Montana and intervening territory. Not yet reported east of the Rocky Mts.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl* 76; Mitt. l. c.

EXSICCATI.—Sull. and Lesq. l.c.

Distinguished from *B. rutabulum*, which it resembles by being dioicous and having a much more slender habit. I have examined a portion of the type and find that it has long filiform-acuminate perichaetial leaves, although this is not in accordance with either Sullivant's or Mitten's figures. Specimens of *B. spurio-rutabulum* from Burrard's Inlet (Macoun, Can. Musc. 651) contain *B. asperrium* mixed with another sterile moss which has very strongly plicate leaves. Authentic specimens of *B. Columbico-rutabulum* from type collection can be separated from *B. asperrium* by nothing excepting that they are said to be monoicous: no male branches could be found on any of the plants examined. Type specimens

of *B. gemmascens* are certainly dioicous; they grew on a wet log and were apparently submerged at times, thus giving an unusual appearance to the plant: its principal leaf characters are identical with those of *B. asperrimum*. Cardot writes that he is sure *B. Villardi* is distinct from *B. asperrimum*, as he found male and female branches on the same plant. I, however, am not able satisfactorily to differentiate it and a specimen from Cardot himself seems dioicous, as a great abundance of male branches were found on one of the plants examined, but not a single female branch. Specimens of *B. subintricatum* from type collection are not distinguishable from *B. asperrimum*. Macoun, Can. Musc. 560 issued as *B. subintricatum* has long, creeping, pinnately branching stems; branch leaves very narrowly lanceolate; sterile. Almost certainly a different moss from the original.

12. BRACHYTHECIUM LAMPROCHRYSEUM C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 199. 1892.

Gametophyte in wide thick tufts, glossy golden-yellow to yellow-green, brown underneath; stems very stout, 5–10 cm. long, creeping and long persisting, ascending at the ends, irregularly divided, sending up numerous secondary stems; secondary stems 3–5 cm. high, irregularly branching, often slightly curved at the ends; branches few or numerous, 5–10 mm. long, terete-foliate; branch leaves distant, open, ovate to ovate-lanceolate, not decurrent, 1.2 x 0.6 mm., acuminate with apex twisted, denticulate all around, strongly plicate; costa stout, extending $\frac{2}{3}$ – $\frac{3}{4}$ length of leaf; median cells linear-oblong, 7–10:1; basal somewhat shorter and broader; alar not differentiated; stem leaves triangular-ovate, slightly auricled, 2–2.5 x 0.8–1.2 mm., more loosely areolate, very strongly plicate; basal and alar cells oblong to elliptical; costa extending $\frac{4}{5}$ the length of the leaf, very slender above: dioicous; male branches gemmiform; perigonial leaves broadly ovate, ecostate, narrowed to a long linear-lanceolate acumination which is 1–2 times as long as the body of the leaf; antheridia oblong, short stipitate; perichaetium 2–3 mm. long; leaves sheathing at base, with squarrose-reflexed tips; inner leaves lanceolate, long filiform-acuminate, nearly ecostate. *Sporophyte* 2–3 cm. high; seta brown, very rough; capsule brown, oblong-cylindric, 2–2.5 mm. long, 2.5–3:1, suberect to horizontal, unsymmetric to arcuate; operculum, annulus and inner peristome unknown; peristomal teeth long filiform-pointed; spores nearly smooth, 16–20 μ .

Type locality, Vancouver, Id. (Macoun).

On decaying wood in moist places, Calif. (Bolander); Mt. Shasta and Graham's Ranch, Calif. (Howe); Colorado (Brandeggee).

The plant from Comox, Vancouver, Id. from which Kindberg evidently described the sporophyte is *B. asperrimum*, hence some discrepancies in the description. The sterile specimens from Mt. Benson and Mt. Finlayson should be regarded as the type. I have described the sporophyte from one of the collections of Mr. M. A. Howe. This species has much the aspect of *B. turgidum*, but has dentate, shorter pointed leaves and rough seta. It is distinguished from *B. rivulare* by its much longer-pointed leaves.

12a. *BRACHYTHECIUM LAMPROCHRYSEUM GIGANTEUM* n. var.

Stems much stouter, secondary stems with fewer branches; stem leaves distant, longer, 3–3.5 mm. long, very strongly plicate; extreme alar cells inflated. Capsule ovoid; operculum conic-rostrate; annulus large, persistent; segments as long as teeth, from a very broad basal membrane; cilia 2 or 3, well developed, nodose; spores maturing in winter. Atku Id., Behring Sea. (U. S. S. Albatross, No. 44. June 10, 1894.)

13. *BRACHYTHECIUM RIVULARE* Br. and Sch. Bryol. Eur. fasc. 52–54. *pl.* 546. 1853.

Gametophyte very robust, in wide thick intricate mats, dark green to yellow-green; stems woody, filiform, creeping, rather sparingly radiculose; young stems distantly foliate with minute leaves, the older apparently leafless, irregularly divided, sending up dendroid secondary stems; secondary stems stout, ascending-arcuate, 3–6 cm. long, nearly free from branches below, irregularly branching above; branches 5–15 mm. long, loosely terete-foliate, tapering; branch leaves erect spreading, ovate to ovate-lanceolate, somewhat decurrent, $1.2-1.5 \times 0.5-0.6$ mm., acute to short acuminate, dentate above with small sharp pointed teeth, strongly concave or somewhat plicate; margins plain or slightly reflexed below; costa extending $\frac{2}{3}$ length of leaf; median cells linear, 10–15:1; basal broader and shorter; extreme alar cells abruptly enlarged; leaves of secondary stems very characteristic, distant, broadly ovate, rather abruptly short acuminate, $1.6-2 \times 1.1-1.4$ mm., concave, more or less plicate, denticulate; costa often forking; median cells

8-10: 1; alar cells abruptly enlarged and inflated; leaves of primary stems triangular-lanceolate, 0.8×0.5 mm., loosely areolate, without chlorophyll: dioicous; male branches stipitate, inner perigonal leaves acuminate with broad much twisted apices: perichaetium 2.5 mm. long; leaves sheathing at base with squarrose points; the inner oblong-ovate, rather abruptly long subfiliform acuminate, entire or slightly denticulate, ecostate. *Sporophyte* 1.5-2 cm. high; seta red-brown, very rough; capsule 2-3 by 1 mm., oblong-ovoid, unsymmetric to arcuate, inclined to horizontal; operculum conic-apiculate; annulus large; segments as long as the teeth; cilia one or two, well developed, strongly nodose; spores 13μ , smooth, maturing in early autumn.

Type locality European.

On moist earth in woods; banks of rivers; on stones in springs and brooks; subaquatic. Northern U. S. and Canada, across the continent south to Virginia; Pribiloff Islands (C. H. Merriam). Not yet reported from California or the extreme western United States. Several plants in the Columbia herbarium from California which have been referred to this species, are *B. lamprochryseum*.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, *Musc. Gall. pl.* 92.

EXSICCATI.—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 1) 337, (Ed. 2) 505; Austin, *Musc. Appal.* 319, 320, 321 and 317 (*B. rutabulum*); Macoun, *Can. Musc.* 288; Ren. & Card. *Musc. Am. Sept. Exsic.* 244.

This species is easily distinguished by its short acuminate stem leaves.

A very interesting form from New Brunswick (Fowler) and Bradford, Pa. (Burnett) has secondary stems 8-10 cm. long and apparently erect; the leaves of these specimens are much more distant than usual. Mr. Burnett states that his plant grew in several inches of water, shaded by grasses and sedges. A rather uncommon form has the secondary stems simple and long flagelliform.

13a. *BRACHYTHECIUM RIVULARE CATARACTARUM* Sauter, *Fl. Herzogth. Salzburg.* 3: 60. 1870.

Floating, dark green to golden green, brown underneath; secondary stems much elongated, simple or sparingly branched;

branches short, directed forward at an acute angle; leaves much more closely imbricated, especially at the tips of the branches.

On timbers of old dam, Staley's Creek, Virginia; sterile. (Dr. J. K. Small.)

14. BRACHYTHECIUM ACUMINATUM (Hedw.) Kindb. Can. Rec. Sci. 1894: 72. 1894.

Leskea acuminata Hedw. Sp. Musc. 224. pl. 56. 1801.

Leskea setosa Hedw. Sp. Musc. 226. pl. 57. 1801.

Leskea Beyrichii Hampe. Linnaea, 13: 47. 1839.

Hypnum acuminatum C. Muell. Syn. 2: 334. 1851.

Hypnum erectum Drumm. Musc. Am. 224.

Homalothecium acuminatum Jaeger & Sauer. St. Gall. Nat. Gesell. 1877-1878: 309.

Gametophyte in wide, rather densely caespitose tufts, green to glossy yellow-green; stems creeping, radiculose, primary branches erect or ascending, 1-3 cm. long, sparingly divided, somewhat radiculose, often with radiculose tips; branchlets unequal, tapering, subjulaceous, terete-foliate; branch leaves erect-imbricated, open and appressed when dry, lanceolate to ovate-lanceolate, somewhat decurrent, $1-1.6 \times 0.4-0.6$ mm., acuminate, more or less serrate above, concave, somewhat plicate; margins often somewhat revolute; costa extending above middle; median cells linear, 9:1; marginal cells broader; basal enlarged, quadrate; leaves of main branches deltoid ovate, broader: dioicous; male branches borne on the stem, gemmiform; antheridia oblong, stipitate; perigonial leaves ovate-lanceolate, long-acuminate, concave: perichaetium 2-2.5 mm. long; leaves loosely erect, the inner ovate-lanceolate to oblong-lanceolate, long filiform-acuminate, distantly dentate above, costate nearly to middle. *Sporophyte* 1.5-2 cm. high; seta red-brown, smooth; capsule brown, cylindric, erect or very slightly curved, varying greatly in size, 1.5-3 mm. long; operculum conic to short rostrate; annulus none; teeth of peristome united at base, lanceolate, with slender hyaline papillose-roughened points, red-brown below, margined; segments linear-lanceolate from a narrow basal membrane, slightly papillose-roughened above, about the length of the teeth; cilia very

rudimentary or none; spores minutely roughened, 12–16 μ , maturing in autumn.

Type locality, Lancaster, Pa. (Muhlenburg).

On decaying wood, bases of trees, rocks and earth, in woods or shady places. Eastern North America west to Minnesota, south to Missouri and Louisiana; not rare.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 116; Hedw. l. c.; Hampe, Icones Musc. *pl.* 7.

EXSICCATI.—Drumm. Musc. Am. (S. States) 124 (*Leskea setosa* var.), 125 (*L. setosa*), 126 (*L. acuminata*); Sull. Musc. Allegh. 72; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 330, (Ed. 2) 491, 492 and 493; Austin, Musc. Appal. 310; Macoun, Can. Musc. 282.

This species is very variable in width of basal membrane, width of segments, shape of leaves and length of acumination, but no one of these variations seems to be correlated with any other.

Hedwig's type has lanceolate branch leaves, becoming broadly lanceolate below; basal membrane of medium width; the plants are small and slender, leaves serrulate above and more contracted at base than usual. The form ordinarily distributed as the species corresponds to Hedwig's *setosa*, but the two cannot be distinguished except as extreme forms of one species. The leaf of *acuminata* figured by Hedwig must be a stem leaf, as the branch leaves of his type are lanceolate. The varieties of the Musc. Bor. Am. of Sull. and Lesq. do not correspond with the original plants.

14a. BRACHYTHECIUM ACUMINATUM RUPINCOLUM (Sull. and Lesq.)
Ren. & Card. Rev. Bryol. 20: 17. 1893.

Hypnum acuminatum rupincolum Sull. and Lesq. Mosses of North America, 336. 1884.

Leskea rupincola Hedw. Sp. Musc. 227. *pl.* 54.

Characterized by an extremely narrow basal membrane. Probably having the range of the species but found most frequently in the southeastern United States.

Var. FILIFORME E. G. Britton, Mem. Torr. Bot. Club, 4: 185. 1893, is not a *Brachythecium*.

15. BRACHYTHECIUM SPLENDENS Aust. Bot. Gaz. 2: 111. 1877.

Brachythecium acuminatum subalbicans Ren. & Card. Bot. Gaz. 15: 60. 1890.

Gametophyte in dense glossy yellow-green mats ; stems creeping, closely applied to the substratum, rhizome like, 4-6 cm. long, sending up erect julaceous, densely foliate branches ; branches terete-foliate, 5-20 mm. long ; branchlets few ; branch leaves erect, closely and regularly imbricate, broadly ovate-lanceolate to triangular-ovate, cordate-auriculate, $1.5-2 \times 0.6-0.8$ mm., concave, 2 to 4 times plicate, distantly and finely denticulate ; costa extending $\frac{2}{3}-\frac{3}{4}$ length of leaf ; median leaf-cells linear, $12-15 : 1$; basal and alar cells rhomboidal to quadrate ; stem leaves broader, deltoid to triangular-ovate : dioicous (?) ; perichaetium 2.5 mm. long ; the leaves sheathing at base with loosely erect tips ; the inner ovate to ovate-lanceolate, abruptly narrowed to a long filiform acumination, distantly dentate-serrate above, thinly costate ; the outer more strongly serrate and nearly ecostate. *Sporophyte* 15 to 25 mm. high ; seta smooth, dark chestnut ; capsule dark chestnut, 2-2.5 mm. long without operculum, oblong-cylindric, erect and symmetric ; teeth of peristome dark red-brown ; segments narrowly linear, from a rather narrow basal membrane, yellow-brown ; cilia single, slender.

Type locality, on palmetto trunks, St. Augustine, Fla., Feb., 1877 (J. Donnell Smith) ; on roots of cypress, Roseville, Fla. (J. D. S.) ; Louisiana (Langlois).

No capsules except such as were old and deoperculate have been seen. The species is beautiful and distinct. It is distinguished from *B. biventreosum* by its much greater size and brilliant color and lustre. Austin's type is a small form of the species ; this, perhaps, led him to confuse it with *B. biventreosum*.

16. BRACHYTHECIUM BIVENTROSUM C. Muell. Bull. Torr. Club, 5 : 49. 1874.

Gametophyte loosely caespitose, light green ; plants small and slender ; stems creeping, subpinnately branching ; branches slender, 3-8 mm. long, julaceous, terete-foliate ; branch leaves appressed-imbricate, lanceolate to narrowly ovate-lanceolate, gradually narrowed to a long slender point, serrulate with small distant teeth, concave or bisulcate at base ; costa extending $\frac{2}{3}$ the length of the leaf ; median cells linear, $10-13 : 1$; basal cells shorter

and broader ; alar quadrate, indistinct : dioicous ; inner perichaetial leaves sheathing at base, more or less abruptly narrowed into a filiform reflexed acumination, dentate above, ecostate. *Sporophyte* 10–15 mm. high ; seta red-brown, smooth ; capsule red-brown, oblong, about 1.8 mm. long and less than half as thick, erect and symmetric ; operculum conic, apiculate ; annulus lacking ; segments of peristome attached to a narrow basal membrane, split between the articulations ; cilia single, rudimentary.

Type specimen on trunks and roots of trees in woods near Baton Rouge, La. (Dr. Joor). (Type seen ; specimens examined by Mueller were communicated to the Columbia Herbarium by Dr. Mohr.)

B. biventreosum is closely allied to *B. acuminatum*, from which it is distinguished by its smaller size and by its very narrowly pointed leaves with fewer and indistinct alar cells.

17. BRACHYTHECIUM CYRTOPHYLLUM Kindb. Ottawa Nat. 4: 63.
1890.

Gametophyte caespitose ; tufts glossy-green, usually densely intricate ; stems irregularly divided and branching ; branches filiform, subjulaceous, 5–10 mm. long ; branch leaves open-erect, appressed-imbricate when dry, ovate to ovate-lanceolate, acute or short acuminate, 0.7×0.3 mm., serrulate, very concave ; margins reflexed below ; costa extending $\frac{2}{3}$ – $\frac{3}{4}$ length of leaf ; median cells fusiform, 4–8 : 1 ; many basal cells shorter and broader ; quadrate alar cells numerous ; stem leaves broadly ovate, acuminate, 0.7×0.4 mm. ; median leaf-cells 3–5 : 1 : dioicous. Sporophyte unknown.

Type locality, Brighton, Northumberland Co., Ontario, October 6, 1888 (Macoun). Type seen.

Roots of trees and old logs. Belleville, Ont. (Macoun) ; Waterloo, N. Y., Austin, 602 ; *Hypnum* (*Brachythecium*) *julaceum* sp. nov. (Ms. notes in Austin's herbarium.)

EXSICCATI.—Aust. Musc. Appal. 311. (*Brachythecium acuminatum* var. *setosum*.)

Closely allied to *B. acuminatum*, distinguished by its filiform stems and branches and small leaves with shorter cells.

18. BRACHYTHECIUM PLUMOSUM (Sw.) Br. & Sch. Bryol. Eur.
fasc. 52-54. *pl.* 537. 1853.

Hypnum plumosum Sw. Disp. Musc. Suec. 66. 1799. Not
Huds. or Hedw.

Hypnum pseudo-plumosum Brid. Musc. Rec. 2²: 108. 1801.

Hypnum flagellare Hedw. Sp. Musc. 282. *pl.* 73, *f.* 1-3.
1801. (*Fide* Limpricht). Not Dicks.

Hypnum chrysostomum Mx. Fl. Bor. Am. 2: 319. 1803.
(*Fide* Limpricht).

Brachythecium rutabuliforme Kindb. Macoun, Cat. Can. Pl. 6:
198.

Gametophyte robust, in wide loosely-intricate mats, brownish-green to golden-green, usually glossy on the surface, brown underneath; stems 3-6 cm. long, creeping, pinnately branching, clinging closely to the substratum at the borders of the mats; branches ascending or erect, straight or somewhat curved, 5-10 mm long; branch leaves equally spreading or somewhat secund, rather loosely erect-spreading, lanceolate to broadly ovate-lanceolate, long-acuminate, 1.1-1.5 $\times$ 0.4-0.5 mm., entire or serrulate near apex, more or less concave, decurrent; costa extending $\frac{2}{3}$ the length of the leaf; median cells linear, 8-12:1; a few basal cells broader and shorter; quadrate alar cells few; stem leaves narrowly triangular-ovate to broadly ovate, acuminate, more loosely areolate, nearly entire: monoicous; male branches abundant; antheridia oblong; inner perigonial leaves ovate-acuminate, bordered by a row of narrow cells, generally costate: perichaetium 1.5-2 mm. long; leaves sheathing with spreading points, oblong-ovate to oblong-lanceolate, rather abruptly narrowed to a long slender acumination, nearly entire, more or less distinctly costate. *Sporophyte* 7-20 mm. high; seta dark red-brown to almost black, rough above, nearly smooth below; capsule chestnut brown, black when old, oblong-ovoid, 2.2-2.5 mm. long, 2.5:1, horizontal to suberect, nearly symmetric or slightly curved, slightly contracted under the mouth when dry; operculum conic, almost rostrate; annulus narrow, of a single row of cells; cilia 2 or 3, well developed, appendiculate; spores nearly smooth, 13-16 μ , maturing in late autumn.

Type locality European.

Subaquatic, on moist rocks in woods and in brooks, especially in mountain regions. Northeastern United States and Canada; west to Minnesota; British Columbia (Macoun); south to North Carolina.

ILLUSTRATIONS.—Br. & Sch. l. c.; Hedw. l. c.; Wils. Bryol. Brit. *pl.* 25; Husnot, Musc. Gall. *pl.* 94.

EXSICCATI.—Sull. Musc. Allegh. 40; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332, (Ed. 2) 496 and 498; Austin, Musc. Appal. 325, 326, 327; Macoun, Can. Musc. 289; Ren. & Card. Musc. Am. Sept. Exsic. 110.

18a. *B. PLUMOSUM HOMOMALLUM* Br. & Sch. l. c. Branches curved at apex, leaves falcate-secund, smaller. With the ordinary form.

EXSICCATI.—Sull. Musc. Allegh. 41 (*Hypnum pseudo-plumosum*; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332^b, (Ed. 2) 497.

Distinguished from most of the species by having the seta smooth below and rough above; from *B. campestre* by having the leaves shorter, more abruptly pointed, nearly entire and not plicate; from *B. populeum* by the shorter costa, which does not extend into the apex; all the accessible descriptions speak of the perichaetial leaves as ecostate, but the perichaetial leaves of Limpricht's Bryol. Sil. 242 and Husnot's Musc. Gall. 277a were very conspicuously costate and such was the case in all the American specimens examined. Specimens of *B. rutabuliforme* from the type collection have the seta nearly smooth below instead of very rough and are certainly referable to *B. plumosum*.

19. *BRACHYTHECIUM POPULEUM* (Hedw.) Br. & Sch. Bryol. Eur. fasc. 52-54, *pl.* 535 and 536. 1853.

Hypnum populeum Hedw. Sp. Musc. 270. *pl.* 70. *f.* 1-6. 1801.

Hypnum Stereodon Laureri Funck; Brid. Bryol. Univ. 2: 595. 1827. (*Fide* Limpricht).

Hypnum saxicola Voit; Sturm, Deutschl. Fl. 2: fasc. 12. 1812.

Brachythecium nanopes C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 201. 1892.

Eurhynchium populeum Kindb. Can. Rec. Sci. 1894: 23. 1894.

Gametophyte in wide, loosely intricate mats, dark green to yellowish green; stems 2–5 cm. long, creeping, stoloniferous, attached to the substratum by dense fascicles of radicles, subpinnately branching; branches 3–10 mm. long, terete-foliate; branch leaves erect-spreading; the upper lanceolate; the lower broadly ovate-lanceolate, $1-1.2 \times 0.25-0.4$ mm., slightly decurrent, subulate acuminate, more or less concave, nearly entire or finely serrate above, margins revolute below; costa stout, extending into the apex; median leaf-cells linear-oblong, 5–8:1; several rows of basal and alar cells rhomboidal to quadrate; stem leaves $1.4-1.8 \times 0.5-0.6$ mm., broadly ovate, slenderly acuminate with apex usually more or less contorted, nearly entire, not plicate or sulcate; leaf-cells broader and shorter: autoicous; male branches gemmiform, abundant; perigonal leaves ovate, abruptly acuminate; the inner faintly costate and serrate at the apex: perichaetium 1.5–2 mm. long; the leaves sheathing at the base, with spreading points, oblong-lanceolate, rather abruptly narrowed to a subfiliform acumination, entire or slightly serrate above; costa well developed. *Sporophyte* 10–15 mm. high; seta red-brown, roughened above with low broad papillae, nearly smooth below, (sometimes nearly smooth throughout); capsule brown, short-ovoid, unsymmetric, horizontal, 2:1; operculum very long-conic; annulus persistent, of a single row of cells; segments as long as the teeth, split between the articulations; cilia stout, variable, 1–3, more or less appendiculate; spores finely roughened, about 15μ , maturing in early winter.

Type locality European.

On stones, roots and trunks of trees, northeastern United States and Canada; Revelstoke, B. C. (Macoun); North Carolina (Brid. l. c.).

ILLUSTRATIONS.—Br. & Sch. l. c.; Wilson, Bryol. Brit. *pl.* 24; Husnot, Musc. Gall. *pl.* 94.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 333, (Ed. 2) 499. Austin, Musc. Appal. 328; Macoun, Can. Musc. 441, 548 (*B. nanopes*).

Quite variable in size and shape of leaves and robustness of

growth. Distinguished by its long-conic operculum, percurrent costa and partially roughened seta.

19a. BRACHYTHECIUM POPULEUM MAJUS Br. & Sch. l. c. *pl.* 536. β .

Stouter glossy, nearly bronze-colored, densely foliate, leaves longer; habit of *B. plumosum*.

On damp stones, Newfoundland (Waghorne).

19 b. BRACHYTHECIUM POPULEUM RUFESCENS Br. & Sch. l. c. ζ

Mats depressed, closely adhering to the substratum; branches short, numerous, erect or ascending; stem leaves appressed, shorter and narrower, broadly lanceolate, bronze colored, seta shorter.

On rocks, New Haven, Ct. (Pease).

19c. BRACHYTHECIUM POPULEUM OVATUM n. var.

Often having the appearance of var. *rufescens*, but with the stem leaves broadly cordate-ovate 1.4 by 0.8 mm., concave, margins reflexed below, rather abruptly narrowed to a much shorter subulate acumination; costa very stout, often ending below apex; branch leaves ovate-lanceolate, median cells 5 : 1.

On dry rocks in woods with *Grimmia apocarpa*. Johnson, Vt. (Grout); Peacham, Vt., (Dr. Blanchard); Indian Falls, Owen Sound (Macoun); New Harbor, Newfoundland, Jan. 30, 1891, (Rev. A. C. Waghorne).

20. BRACHYTHECIUM DIGASTRUM C. Muell & Kindb. Macoun, Cat. Can. Pl. 6 : 190. 1892.

Gametophyte in wide, olive-green mats, not glossy; stems radiculose, creeping and closely applied to the substratum, pinnately branching; branches 5–10 mm. long, subjulaceous, terete-foliate; branch leaves loosely appressed-imbricate when dry, erect-open when moist, ovate to oblong-ovate, acute to short acuminate with apex more or less twisted, 0.8–1 mm. long and about $\frac{1}{2}$ as broad, decurrent, bisulcate, very concave; margins reflexed below, serrulate; costa stout, extending $\frac{2}{3}$ – $\frac{3}{4}$ length of leaf; median cells fusiform-hexagonal, 5–7 : 1; basal much shorter; quadrate alar cells numerous; stem leaves triangular-ovate, longer acuminate,

more loosely areolate at base, less conspicuously serrulate, 1.2×0.8 mm.: monoicous; perichaetium 2–2.5 mm. long, sheathing; leaves slightly or not at all reflexed at apex, oblong-ovate, thinly costate, very loosely areolate, rather abruptly contracted into a long filiform flexuous acumination, slightly denticulate or entire. *Sporophyte* 15–20 mm. high; seta red-brown, smooth; capsule brown, oblong-arcuate, subhorizontal, 2–2.5 mm. long, 3:1; operculum long-conic, apiculate; segments shorter than the teeth; “cilia nodulose, not appendiculate, annulus none.”

Type locality, McKay's bush, Ottawa, Ont., Oct. 12, 1889, (Macoun); Canaan Forks, N. B., 1889, (J. Moser). On rocks.

Authentic specimens from McKay's bush have been carefully studied. The species is entirely distinct from *B. oxycladon*. It is distinguished from that species by the shorter and shorter acuminate leaves, shorter leaf-cells, more numerous quadrate alar cells and shorter capsule. In general appearance it resembles *B. Novae Angliae*, but it is easily distinguished by its being monoicous and having a large area of clearly differentiated quadrate alar cells. Its microscopic characters place it clearly in the section with *B. populeum* from which it is distinguished by the broader branch leaves with shorter costa and by its smooth seta.

21. *BRACHYTHECIUM REFLEXUM* (Starke) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl.* 539. 1853.

Hypnum reflexum Starke; Web. & Mohr. Bot. Taschenb. 306 and 476. 1807.

Leskea laxifolia Hook. Musc. Exot. *pl.* 30. 1818.

Hypnum laxifolium Schwaegr. Musc. Frond. Suppl. 2, 1: 159. *pl.* 143. 1824. Lesq. & James, Man. 342. 1884.

Hypnum subtenue James, Proc. Acad. Phila. 1855: 447. 1855.

Rigodium reflexum Kindb. Laubm. Schwed u. Norway, 14. 1883.

Eurhynchium reflexum Kindb. Can. Rec. Sci. 1894: 22. 1894.

Gametophyte in wide, loosely intricate, dark green mats (occasionally yellow-green in sunny places); stems filiform, 5–10 cm. long, arcuate-procumbent, radiculose at points of contact with substratum, pinnately branching; branches filiform, about 5 mm. long, ascending, terete-foliate, attenuate at apex, not radiculose; branch leaves erect-open, loosely appressed-imbricate when dry,

lanceolate, decurrent, $0.6-0.9 \times 0.25-0.4$ mm., gradually acuminate, serrate above, slightly concave; costa stout, extending into apex; median cells oblong-rhomboidal to oblong-hexagonal, 3-5 : 1; quadrate alar cells very numerous, extending up the sides of the leaf; stem leaves $0.8-1.2 \times 0.5-0.8$ mm., deltoid-ovate, long acuminate; acumination equaling $\frac{1}{3}$ to $\frac{1}{2}$ entire length of leaf: monoicous; male branches abundant, borne on the stem; antheridia oblong; perigonal leaves ovate, acuminate, very loosely areolate: perichaetium 2 mm. long; leaves sheathing at base with spreading tips; inner leaves oblong-ovate, long-acuminate, entire or serrate at apex, nearly ecostate. *Sporophyte* 10-15 mm. high; seta red-brown, very rough, twisted to the right below and usually to the left above; capsule red-brown to nearly black when old, 2 mm. long, 2 : 1, ovoid, horizontal, not constricted under the mouth when dry; operculum conic, apiculate; annulus of two rows of cells; cilia 2 or 3, stout, appendiculate; spores nearly smooth, $15-18\mu$, maturing in autumn or early winter.

Type locality European.

On decaying logs, roots of trees and detritus of siliceous rocks. Mountains of northern United States and eastern Canada; west to Lake Huron (Macoun) and Montana (R. S. Williams); Maryland (J. D. Smith).

ILLUSTRATIONS.—Br. & Sch. l. c. Husnot, *Musc. Gall. pl.* 94; Rab. *Krypt. Fl.* 4³: f. 373.

EXSICCATI.—Sull. & Lesq. *Musc. Bor. Am.* (Ed. 2) 503; Austin, *Musc. Appal.* 540; Macoun, *Can. Musc.* 286.

Limpricht l. c. states that the spores are papillose but I have been unable to find rough spores in either European or American material. Easily distinguished from the other American species by its filiform stems and branches and the areolation of the leaves approaching that of *Amblystegium*.

Hooker's type of *Leskea laxifolia* from the Northwest Coast (Menzies) has been seen and Dr. Best, Mrs. Britton and myself are agreed that it is this species.

22. BRACHYTHECIUM GLACIALE Br. & Sch. *Bryol. Eur. fasc.* 52-54. *pl.* 542. 1853.

Gametophyte in loose glossy mats, yellow-green to brownish green; stems creeping or decumbent, subpinnately branching;

branches 5–8 mm. long; branch leaves often somewhat secund, loosely erect-spreading, decurrent, lanceolate, $1-1.2 \times 0.4-0.6$ mm., smaller toward the end of the branches, narrowly acute to acuminate, serrate, faintly or not at all plicate; costa extending nearly or quite to apex, often toothed on the back above and ending in a spine; median leaf-cells linear-oblong, $8-10:1$; quadrate alar cells very numerous; stem leaves ovate, long-acuminate monoicous; perigonial leaves ovate, acuminate, serrulate at apex; antheridia short oblong: perichaetium sheathing, about 2 mm. long; inner leaves oblong-lanceolate, rather abruptly filiform acuminate with acumination erect or spreading, serrulate at apex, nearly or quite ecostate. *Sporophyte* 2–3 cm. high; seta red-brown, rough; capsule horizontal, unsymmetric, short-ovoid to subglobose, about 2.5 mm. long, $2:1$; operculum conic-apiculate; annulus of two rows of cells, persistent; segments a little shorter than the teeth; cilia 2 or 3, long appendiculate in the American specimens; spores nearly smooth, about 12μ , maturing in winter.

Type locality European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, *Musc. Gall.* *pl.* 94; Rab. *Krypt. Fl.* 4³: *f.* 372.

Collected at Middle Arm, Bay of Islands, Newfoundland, February 11, 1896, by Rev. A. C. Waghorne.

Possesses characters intermediate between *B. Starkii* and *B. reflexum*. From *B. reflexum* it is easily distinguished by its more robust habit, and from *B. Starkii* by the usually percurrent costa. The length of the costa varies considerably even in the same plant.

Through the kindness of Professor Eug. Warming, of Copenhagen, specimens of the Greenland moss referred to *Brachythecium glaciale* Br. & Sch. (*Fl. Gr.* p. 337) have been seen. They are sterile and are certainly not *B. glaciale*. They resemble slender specimens of *B. rutabulum* more closely than they do any other American species.

23. BRACHYTHECIUM STARKEI (Brid.) Br. & Sch. *Bryol. Eur.* fasc. 52–54. *pl.* 541. 1853.

Hypnum Starkei Brid. *Musc. Rec.* 2²: 107. 1801.

Eurhynchium Starkei Kindb. *Can. Rec. Sci.* 1894: 23. 1894.

Gametophyte in wide, loose mats, dark green, seldom whitish-green; stems irregularly divided, pinnately branching, decumbent or ascending, arcuate and rooting at the tips; branches 5–20 mm. long, ascending and arcuate at the ends, more or less complanate-foliate; middle branch leaves distant, spreading, ovate-lanceolate, $1.4-1.7 \times 0.7-0.9$ mm., narrowly acute to acuminate, with apex often twisted, somewhat decurrent, strongly serrate, not plicate or sulcate when moist; costa extending beyond the middle; median cells linear-fusiform, 13:1; basal shorter and broader; a few of the alar cells rhomboidal to quadrate; stem leaves broadly ovate, broadly long-acuminate, less strongly serrate, more loosely areolate with a much larger area of rhomboid-quadrate cells at the base and alar angles: monoicous; male branches frequent, gemmiform; perigonial leaves ovate, acuminate, the outer with a well-defined costa: perichaetium 2.5 mm. long; leaves loosely sheathing with squarrose points; inner leaves oblong-lanceolate, gradually long and narrowly acuminate, costate, nearly entire; outer leaves shorter, ecostate. *Sporophyte* 2–2.5 cm. high; seta red-brown, roughened with large distinct papillae; capsule oblong-ovoid, dark red-brown, 2–2.5 mm. long, $\frac{1}{2}$ as thick, strongly arcuate, horizontal, slightly narrowed under the mouth when dry; operculum conic; annulus of about two rows of cells; segments a little shorter than the teeth; cilia 2 or 3, appendiculate; spores nearly smooth, about 14μ , maturing in winter.

Type localities European.

On decaying logs and stumps in moist mountain regions. Northern United States and Canada across the continent; Vancouver Island (Macoun); Montana (R. S. Williams); south to New Jersey and Pennsylvania.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, *Musc. Gall. pl. 94*; Rab. *Krypt., Fl. 4³. f. 368*.

EXSICCATI.—Sull. & Lesq. *Musc. Bor. Am. (Ed. 1) 336*, (Ed. 2) 504; Austin, *Musc. Appal. 323*.

Fragmentary specimens of *Hypnum oedipodium* Mitt. (Journ. Linn. Soc. 8: 32. 1865) of the type collection and from both the localities cited in the original description have been examined and could not be differentiated from the ordinary American *B. Starkei*. Specimens of *B. curtum* Lindb. identified by Lindberg him-

self, have been accessible through the kindness of V. F. Brotherus. The costa of the upper branch leaves was often found ending in a spine, and the cilia were also appendiculate. I have thus far been unable to differentiate *B. curtum* from *B. Starkei* in either American or European material. All the characters given as distinctive are quite variable, even on the same plant in many cases. The majority of the specimens of *B. Starkei* from northeastern North America are more loosely intricate and straggling than the typical European plant, they are also markedly complanate foliate and the costa often ends in a spine and is toothed on the back above. These forms are probably referable to var. *complanatum* Limpr. l. c.

24. BRACHYTHECIUM NOVAE-ANGLIAE (Sull. & Lesq.) Jaeger & Sauer. St. Gall. Nat. Gesell. 1876-1877 : 328.

Hypnum Novae-Angliae Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 338. 1856. Sull. Mosses of U. S. 76. 1856.

Eurhynchium Novae-Angliae Kindb. Can. Rec. Sci. 1894 : 23. 1894.

Gametophyte in wide loosely intricate mats, bright green on the outside, dirty brownish-green below, stems decumbent; secondary stems sub-erect, about 5 cm. long, subpinnately branching; branches erect-ascending, terete-foliate, subjulaceous, not attenuate, 5-10 mm. long; branch leaves erect-open, loosely appressed-imbricate when dry, ovate, decurrent, $0.8 \times 0.4-0.5$ mm., serrulate, very concave, not plicate, long acute to short acuminate; apex twisted $\frac{1}{2}$ turn to the right; costa thick, extending beyond the middle of the leaf; median leaf-cells oblong-hexagonal, 5 : 1; alar and basal cells little differentiated; each leaf-cell with a small papilla at one end; stem leaves broadly ovate to triangular-ovate, 1×0.8 mm., longer acuminate; leaf-cells shorter: dioicous; male branches gemmiform; antheridia oblong; perigonial leaves oblong-ovate, gradually long-acuminate: perichaetium about 2 mm. long; the leaves with sheathing bases and squarrose points; inner leaves oblong, long filiform-acuminate, somewhat serrulate above, costate. *Sporophyte* 1-2 cm. high; seta dark red-brown, very rough with broad low papillae; capsule dark red-brown, almost black when old, oblong cylindric, 3-3.5 mm. long, 4-5 : 1, somewhat arcuate, horizontal to suberect; operculum long-conic, subrostellate; annulus large; segments nearly as long as the

teeth ; cilia one or two, nearly as long as the segments, strongly nodose ; spores minutely roughened, $17-19\mu$, maturing in autumn.

Type locality, mountains of New England.

On earth and stones in wet shady places, especially in mountain regions. Northeastern United States and eastern Canada ; south to Maryland ; west to Wisconsin.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 118.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 338, (Ed. 2) 507 ; Aust. Musc. Appal. 329 ; Macoun, Can. Musc. 440 ; Ren. & Card. Musc. Am. Sept. Exsic. 109.

Easily distinguished by its rostellate capsule, short leaf-cells and twisted leaf apices. The species varies considerably in length of the acumination of leaves so that var. *Delamarei* Ren. & Card. Fl. Miq. 50, does not seem worthy of special mention, although I have not seen specimens of that form.

25. BRACHYTHECIUM VELUTINUM (L.) Br. & Sch. Bryol. Eur. fasc. 52-53. *pl.* 538. 1853.

Hypnum velutinum L. Sp. Pl. 358. 1753.

Hypnum intricatum Schreb. Sp. Flor. Lips. 1771.

Hypnum declivum Mitt. Journ. Linn. Soc. 8: 33. *pl.* 6. 1865.

Brachythecium pseudo-erythrorrhizon Kindb. Hedwigia, 35: 68. 1896.

Gametophyte in wide, dark green to light yellowish-green mats ; primary stems about 5 cm. long, creeping, radiculose with fascicled radicles, irregularly divided, very sparingly leafy, leaves often reduced or even wanting in places, branching irregularly pinnate ; branches short, 2-5 mm. in length ; branch leaves loosely spreading, somewhat falcate-secund at the ends of the branches, lanceolate to ovate-lanceolate, $1-1.3 \times 0.25-0.30$ mm., gradually long-acuminate ; apex usually falcate or twisted ; margin serrate ; costa extending beyond the middle, often toothed above on the back ; median cells linear, 12:1 ; quadrate alar cells very few, confined to the extreme angles ; stem leaves more narrowly lanceolate, usually longer acuminate, often much reduced in size : monoicous ; male branches gemmiform ; antheridia short-oblong, nearly sessile ; inner perigonial leaves ovate-lanceolate, acute, bordered

by a row of elongated cells: perichaetium 2 mm. long; leaves few, sheathing at base, the inner oblong-ovate, rather abruptly narrowed to a long acumination, sharply dentate above; costa wanting or short and slender. *Sporophyte* 15 mm. high; seta light brown, sometimes reddish, very rough, slightly or not at all twisted; capsule brown, short-oblong, arcuate, horizontal, contracted under the mouth when dry, 2–2.5 mm. long, 2–3:1; operculum conic; annulus large, easily detachable; segments lanceolate, as long as the teeth, attached to a basal membrane of median width, more or less split along the keel; cilia 2 or 3, nodose or subappendiculate; spores yellow-brown, minutely roughened, 10–13 μ , maturing in autumn or winter.

Type locality European.

On earth or stones and trunks of trees at the base, in shady places. Northern United States and Canada, south to New Jersey; Calif. (Howe).

ILLUSTRATIONS.—Dill. Hist. Musc. *pl.* 42, *f.* 61; Br. & Sch. l. c.; Mitt. l. c.; Wils. Bryol. Brit. *pl.* 26; Husnot, Musc. Gall. *pl.* 95.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 500; Austin Musc. Appal. 324; Macoun, Can. Musc. 379.

Varying a great deal in robustness, roughness and length of seta and color of capsule, capsule often yellow-green. "A very variable species, plants slender or robust; stems more or less divided, and the branchlets varying in length; leaves close or more distant, bright green or yellow, opaque or glossy; capsule subglobose or oblong, on a short or long pedicel." Lesq. & James, Mosses of N. A., p. 340. *B. pseudo-erythrorrhizon* Kindb. is inserted as a synonym on the authority of M. Cardot (*Vide* Hedwigia 35: 308, 1896) as no specimens have been accessible.

26. BRACHYTHECIUM LEIBERGII n. sp.

Gametophyte in wide densely intricate green mats; stems decumbent or ascending, 3–5 cm. long, pinnately branching; branches 5–10 mm. long; branch leaves falcate-secund, decurrent, 1.2 $\times$ 0.4 mm., lanceolate, bisulcate or often plicate, gradually very slenderly acuminate, serrate, costate to beyond the middle; median cells fusiform, 8–10:1; basal shorter and broader; quadrate alar cells numerous; stem leaves ovate to ovate-lanceolate, more strongly

plicate : monoicous ; male branches abundant, perigonal leaves ovate, acuminate, $1.4-1.6 \times 0.6$ mm. ; costa lacking or faint : perichaetium 2.5 mm. long, loosely sheathing ; leaves oblong-ovate, abruptly filiform-acuminate, nearly ecostate. *Sporophyte* 1.5-2 cm. high ; seta red-brown, roughened with rather low blunt papillae, little twisted ; capsule light brown, 1.5 mm. long, $1.5-2 : 1$, short-ovoid, unsymmetric, horizontal ; operculum short conic ; annulus present ; segments as long as teeth, cilia two or three, well-developed, appendiculate ; spores smooth, $10-12\mu$, maturing in winter or early spring.

Type locality, summit of "Bareknob" Traille River Basin, Idaho, alt. 5500 ft. (J. B. Leiberg, 288. July, 1891).

The gametophyte closely resembles *B. erythrorrhizon*, from which it differs in the rough seta and in being monoicous. Easily distinguished from *B. velutinum* by the larger stem leaves.

27. BRACHYTHECIUM IDAHENSE R. & C. Bot. Gaz. 15 : 60. 1890.

Gametophyte in bright green, loosely intricate tufts ; stems creeping, irregularly pinnate, branches ascending, somewhat curved at the ends, about 5 mm. long ; branch leaves loosely erect-spreading, subsecund, more or less falcate, $0.6-0.9 \times 0.3-0.4$ mm., ovate-lanceolate, acuminate, strongly serrate, concave ; margins reflexed below ; costa stout, extending $\frac{2}{3}-\frac{3}{4}$ length of leaf ; median cells linear-vermicular, $6-8 : 1$; basal cells broader and shorter, alar quadrate ; stem leaves larger, $0.8-1 \times 0.35-0.5$ mm., lanceolate from an ovate base, long-acuminate, plicate ; basal cells more enlarged : monoicous ; perichaetium 2 mm. long, sheathing ; inner leaves nearly erect, oblong-lanceolate, very abruptly acuminate, serrate, nearly ecostate. *Sporophyte* 10-17 mm. high ; seta red-brown, smooth ; capsule $1.5-2.5 \times 1$ mm., ovoid, unsymmetric and horizontal ; operculum obtusely conic ; annulus large, of two rows of cells ; segments as long as teeth ; cilia 2, long, nodulose to subappendiculate ; spores roughened, $10-12\mu$ maturing in autumn.

Type locality, Lake Pend d'Oreille, Idaho, on logs. (Leiberg No. 130 in part) ; also Belt Mts. Montana, November 3, '91 (R. S. Williams).

Type specimens examined. This moss is clearly one of the *velutinum* group and is most likely to be mistaken for *B. suberythrorrhizon* or *B. collinum*; it differs from the former in the smaller, shorter leaves and abruptly acuminate perichaetial leaves; from the latter in the more robust habit and the less abruptly acuminate and falcate stem and branch leaves. The seta often bears traces of papillae. The author remarks, l. c., that "This species rather resembles *B. Bolanderi*, from which it is distinct by the smooth pedicel, monoecious inflorescence, the thicker capsule, the larger size and bright green tint of the tufts. It is more closely allied to the European *B. olympicum* Jur. from which it differs in the larger size, the larger broader plicate leaves, the basal areolation looser, with angular cells more numerous, quadrate, thin-walled, the costa narrower and shorter and the lid obtuse, not apiculate."

28. BRACHYTHECIUM SUBERYTHRORRHIZON Ren. & Card. Bot. Gaz. 19: 238. 1894.

Gametophyte in thin tricate mats, green; stems creeping, sub-pinnately branching; branches 3–5 mm. long, decumbent or ascending; branch leaves oblong-lanceolate, long and slenderly acuminate, somewhat falcate, $1-1.2 \times 0.3-0.35$ mm., strongly serrate above, strongly concave or bisulcate, margins reflexed; costa extending beyond the middle; median cells linear, 10–15:1; basal broader and shorter; quadrate alar cells numerous; stem leaves oblong-lanceolate to ovate-lanceolate, $1.4 \times 0.4-0.5$ mm.: monoicous; perichaetium about 2 mm. long; leaves sheathing at base with erect-spreading points, ovate to ovate-lanceolate, filiform-acuminate, serrate at apex. *Sporophyte* 12–15 mm. high; seta smooth, red-brown; capsule brown, ovoid, suberect to horizontal, 2–2.5 by 1 mm., little or not at all contracted under the mouth when dry; operculum conic; annulus large, easily detachable, often coming off with operculum; segments as long as the teeth; cilia 1 or 2, well developed, nodose; spores 13μ , slightly roughened.

Type locality, Springdale, Boulder Co., Colorado (Mary Hol-zinger). Type seen.

"Nearly allied to *B. erythrorrhizon* Br. & Sch. from which it differs in the narrower leaves and the looser areolation." Also in

the shorter pointed leaves and in being monoicous. Too close to *B. Idahense* from which it is distinguished by the larger, narrower leaves and gradually acuminate perichaetial leaves.

29. *BRACHYTHECIUM COLLINUM* (Schleich.) Br. & Sch. Bryol. Eur. fasc. 52-54, *pl.* 548. 1853.

Hypnum collinum Schleich. Cat. 1815.

Leskea Fendleri Sull. Mem. Am. Acad. 4: 169. *pl.* 1. 1849.

Hypnum Fendleri Sull. Icon. Musc. 189. *pl.* 117. 1864.

Brachythecium Hillebrandi Lesq. Mem. Calif. Acad. 1¹: 33. 1868.

Eurhynchium collinum Kindb. Can. Rec. Sci. 1894: 22. 1894.

Gametophyte small, slender, in thin intricate mats, bright green and glossy above, often dirty green below; stems creeping, radiculose, much branched; branches erect, slender, usually julaceous, often subdivided, 3-6 mm. long, terete-foliate; branch leaves closely imbricate, ovate to broadly ovate-lanceolate, 0.3-0.5 $\times$ 0.7-0.9 mm., rather abruptly acuminate, serrulate at base, sharply serrate above, concave; costa extending to middle; median cells linear-oblong to fusiform, 3-6:1; quadrate alar cells numerous, usually chlorophyllose, extending up the margin; stem leaves broadly ovate: monoicous; male branches gemmiform, numerous, borne on the branches; antheridia oblong; inner perigonial leaves ovate-lanceolate, acuminate, serrate, ecostate: perichaetium 1.8-2 cm. long; inner leaves oblong-ovate, abruptly narrowed to a slender acumination, serrate; costa thin and short or wanting; upper leaf cells linear, the lower broader. *Sporophyte* 5-12 mm. high; seta yellow-brown, smooth or slightly roughened; capsules brown, ovoid, unsymmetric to arcuate, contracted below the mouth when dry, 2 mm. long, 2:1; operculum conic; annulus broad, of two rows of cells, easily detached; the segments as long as the teeth, lanceolate, attached to a basal membrane of medium width; cilia well developed, one or two, with sometimes rudiments of a third, nodose; spores yellow-brown, very nearly smooth, 10-12 μ , maturing in autumn.

Type locality European.

On earth and rocks in mountains of western United States and

Canada ; Peace River, Mt. Shasta, Colorado, Montana, New Mexico, and intermediate points ; Greenland (Fl. Gr.).

ILLUSTRATIONS.—Br. & Sch. l. c. ; Sull. l. c.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 501, (*Hypnum Fendleri*) ; Macoun, Canadian Musci, 398 ; Röll 1540, 1540^a, 1565^a. Ren. & Card. Musc. Am. Sept. Exsic. 107.

After a critical examination of two sets of Fendler's collection from the type locality of *Leskea Fendleri*, no valid distinction between this and *B. collinum* could be detected as the setae of *B. collinum* is usually slightly roughened in both European and American specimens. Also one capsule of Fendler's plant had two well developed cilia. No specimens of *Brachythecium Hillebrandi* of the original collection have been accessible and all the specimens examined which have been referred to this are undoubtedly *B. collinum*. There are no distinctions except the shorter capsule, rough seta and simple annulus. The length of capsule is always subject to considerable variation.

B. collinum frequently has a rough seta and the terms simple and compound, as applied to the annulus, have been used in a very loose way.

30. BRACHYTHECIUM UTAHENSE James, Bot. King Exped. 409.
1871.

Hypnum Utahense Lesq. & James, Mosses of North America, 339. 1884.

Eurhynchium Utahense Kindb. Can. Rec. Sci. 1894 : 22. 1894.

Gametophyte light green, loosely caespitose, small and slender ; stems short, creeping, radiculose, irregularly branching ; branches 3–5 mm. long ; branch leaves pluriseriate, loosely imbricate, oblong-lanceolate to ovate-lanceolate, 0.9 × 0.3–0.4 mm., acuminate, serrulate below, serrate above, somewhat concave ; margins slightly reflexed below ; costa extending to the middle or beyond ; median cells linear-fusiform, length 6–9 : 1 ; quadrate alar cells numerous : synoicous ; antheridia mixed with the archegonia, oblong : perichaetium 0.8 mm. long ; inner leaves serrate, acuminate from a broad sheathing base, ecostate. *Sporophyte* about 5 mm. high ; seta brown, smooth ; capsules brown, subglobose to oblong-ovoid, erect, nearly or quite symmetric, 2 mm. long, 3 : 1 ; operculum long-conic ; annulus obscure ; segments linear-lanceolate, as long as the teeth ; basal membrane comparatively narrow ; cilia rudi-

mentary, 1 or 2; spores yellow-brown, very slightly roughened, $10-15\mu$, maturing in winter.

Type locality, sandstone rocks overhanging a dry stream bed near Hanging Rock Station, Echo Canyon, Utah, Alt. 6000 feet (Watson); also found at Bald Mt., western Montana (Watson); Arizona (Pringle).

ILLUSTRATIONS.—Sull. Icon. Musc. Suppl. *pl.* 73.

Closely allied to *B. collinum* but easily distinguished by the erect capsule and rudimentary cilia.

31. BRACHYTHECIUM ERYTHRORRHIZON Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 547. 1853.

Eurhynchium erythrorrhizon Kindb. Can. Rec. Sci. 1894: 23. 1894.

Gametophyte in wide, intricate mats, light green, somewhat glossy; stems slender, 4 cm. or more long, radiculose, pinnately branching, not stoloniferous; branches 3-8 mm. long, ascending, the longer often arcuate and decumbent; branch leaves erect-spreading, $1-1.5 \times 0.3-0.5$ mm., more or less falcate-secund, lanceolate to ovate-lanceolate, gradually long and narrowly acuminate, serrate above, often plicate, costate to above the middle; margins more or less reflexed; median cells linear-vermicular, 8-10:1; quadrate alar cells distinct; stem leaves larger, ovate to ovate-lanceolate, plicate, nearly entire: dioicous; perichaetial leaves loosely erect, ovate to oblong-lanceolate, long and narrowly acuminate. *Sporophyte* 10-15 mm. high; seta red-brown, smooth; capsule red-brown, ovoid, unsymmetric and horizontal, 2 mm. long, 2-2.5:1; operculum conic, apiculate; annulus present; segments somewhat shorter than the teeth; cilia 1 or 2, well developed; spores $14-20\mu$, roughened, maturing in autumn.

Type locality European.

Washington, Clealum Lake Ridge (Röll) no. 933; Belt Mountains and Columbia Falls, Montana (R. S. Williams); Colorado (Brandeggee); White Mountains (Austin, 1872); Newfoundland (Rev. A. C. Waghorne).

ILLUSTRATIONS.—Br. & Sch. l. c.

Careful comparisons of this species with specimens of *B. harpi-*

dioides C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 194, make it almost certain that the two are identical. Although Prof. Macoun assures me that the specimens sent are identical with Kindberg's types, the plant from New Brunswick is not the same as that from British Columbia which appears to be *B. erythrorrhizon*.

31a. BRACHYTHECIUM ERYTHRORRHIZON THEDENII (Br. & Sch.)
Lindb. Musc. Scand. 36. 1879.

Brachythecium Thedenii Br. & Sch. Bryol. Eur. fasc. 52-54.
pl. 17. 1853.

Stems 5-10 cm. long, slender and creeping, often stoloniferous; branching regularly pinnate; branch leaves long filiform-acuminate; perichaetial leaves very long filiform-acuminate. Seta distantly but distinctly papillose.

Errol Dam, Androscoggin River, N. H. (James).

The variety is one of the rarest of mosses, found in Europe only in Finland and Sweden.

James' plant has been carefully compared with authentic European specimens and differs chiefly in the larger leaves which approach the typical form. The slightly scabrous seta is a character not heretofore noted, but it is quite conspicuous in specimens from Sweden which were identified by Schimper himself.

Schimper's figure exaggerates the serration of the perichaetial leaves.

32. BRACHYTHECIUM BOLANDERI (Lesq.) Jaeger & Sauer. St. Gall.
Nat. Gesell. 1877-78: 324.

Hypnum Bolanderi Lesq. Trans. Am. Phil. Soc. 13: 12. 1869.

Eurhynchium Bolanderi Kindb. Can. Rec. Sci. 1894: 22.
1894.

Gametophyte in wide, pale green mats; stems 3-5 cm. long, irregularly divided, creeping, subpinnately branching, sparsely radiculose; branches 3-6 mm. long, ascending, terete-foliate; branch leaves erect-spreading, rather distant, ovate-lanceolate, gradually acuminate, 0.6-0.8 $\times$ 0.25-0.3 mm., serrate all around, not concave or plicate, costa extending beyond the middle; median leaf-cells rhomboidal-fusiform, 5-10:1; basal cells shorter and broader; quadrate alar cells few; stem leaves smaller, less distinctly

serrate, often nearly entire: dioicous; perichaetium 2 mm. long, loosely sheathing; inner leaves oblong-lanceolate, long filiform-acuminate, serrate with a few distant teeth, costa slender or lacking. *Sporophyte* 1–1.5 cm. high; seta blood red, very rough; capsule brown, 1.5–2 mm. long, 2:1, ovoid, unsymmetric, horizontal; operculum conic-apiculate; annulus large, compound; teeth of peristome red-brown below; segments a little shorter than the teeth, from a broad basal membrane; cilia 2, as long as the segments, nodose; spores nearly smooth, about 10μ , maturing in April.

Type locality, on shaded ground, Calif. (Bolander); also collected at Olema, Marin Co. (Howe).

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 502.

DOUBTFUL AND IMPERFECTLY KNOWN SPECIES.

33. *BRACHYTHECUM MIRABUNDUM* C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 194. 1892.

“Tufts large, very laxly cohering, nearly without rhizoids, silky or yellowish-green, faintly shining. Stem elongate, irregularly divided or prolonged into sciuroid-curved, obtuse branches. Leaves loosely imbricate, crowded, when dry subrugose, when moist patent, short decurrent, indistinctly auriculate, faintly plicate, from the concave, ovate and gradually acuminate base long-cuspidate; borders broadly recurved at least at one side of the nearly entire base to the involute and distinctly denticulate acumen; cells pale, elongate, and narrow, the alar subquadrate and not much wider than the other basal ones, all sparingly chlorophyllose; costa vanishing in the acumen. Capsule small, at the base indistinctly gibbous, narrow, cylindric, and curved; lid elongate-conic; pedicel very short, 0.5–0.8 cm., very faintly muriculate. Perichetial leaves nerveless, longer filiform-cuspidate, irregularly sinuolate, the point patent or arcuate; basal cells larger, rectangular; archegonia numerous, about 20. Monoicous.”

“This species is allied to *Brachythecium rutabulum*, differs principally in the minutely muriculate and short pedicel of the small, narrow capsule, also in the leaves.”

“On old logs in woods, Canaan Forks, Queen's Co., and Elmwood, King's Co., N. B., July, 1888 (J. Moser).”

Although I have had all of Professor Macoun's material of this species, I have not found any trace of the sporophyte and am unable clearly to differentiate this species from *B. rutabulum*. The stem leaves are more slender-pointed than is usual with *B. rutabulum* and are also somewhat plicate.

34. BRACHYTHECIUM PSEUDO-STARKEI Ren. & Card. Bot. Centralbl. 44: 423. 1890.

"Dioicous, loosely caespitose, green; stem erect or ascending, flexuous, laxly pinnate, branches elongate, attenuate: leaves not close, patulous, ovate-lanceolate, plicate, acuminate, acumen long, sometimes tortuous; margin generally serrate all around; costa extending into the acumen; cells linear-rhomboidal, elongate, attenuate, alar lax, soft, quadrate, hyaline: not fruiting."

Washington. (Röll.)

Evidently aquatic, very lax and distantly foliate, with the habit of an *Amblystegium*. Related to *B. rivulare* and *B. rutabulum*; distinguished from both by its slender habit; from the first by its more slender-pointed leaves; from the second by having the leaves plicate and the branch leaves shorter-pointed. Stem leaves 1.8–2 by 1 mm.; middle branch leaves 1.4 by 0.8 mm.

35. BRACHYTHECIUM RÖLLII Ren. & Card. Bot. Centralbl. 44: 422. 1890. Hedwigia, 32: 263. 1893.

"Dirty or yellowish-green: stems soft, depressed, scarcely radiculose, subpinnate; branches elongate, flexuous: leaves ovate-lanceolate, decurrent, quite long and narrowly acuminate, faintly plicate; margin sinuate or denticulate, plane in middle, revolute at base and at acumen; costa reaching beyond middle to $\frac{2}{3}$ length; cells narrow, elongate, linear, alar cells few subquadrate; evidently dioicous."

Vancouver. (Röll.)

The leaves of this species are shaped much like those of *B. plumosum*, but they are conspicuously dentate.

36. BRACHYTHECIUM CAVERNOSUM Kindb. Rev. Bryol. 22: 86. 1895.

"Differs from *B. rutabulum*: leaves very concave, plicate,

recurved on both sides to the acumen ; lower basal and alar cells small, green and not well defined ; lid of the capsule longer apiculate or rostellate."

"Amer. Canada : White, com. Macoun."

37. BRACHYTHECIUM CALCAREUM Kindb. l. c.

"Resembles *B. intricatum* (*Hypnum* Hedw., *Brachythecium velutinum* (var.) Schimper) in the habit ; differs from *B. lactum* (Brid.) Kindb. (non Schimp.), not occurring in Europe, in the entire stem-leaves, the larger alar cells and the shorter costa, from *B. salebrosum* also in the leaves curved or secund in dry state."

"Leaves crowded, long-acuminate and filiform-pointed, denticulate at the acumen or (the stem-leaves) nearly entire, more or less recurved, incurved falcate when dry, patent when moist ; cells linear, the angular short, the alar ones few, much larger and hyaline. Stem-leaves with a broad base ; costa short, mostly vanishing near the middle. Branch leaves narrow ; costa nearly reaching to the acumen. Capsule small, arcuate ; cilia not appendiculate ; lid apiculate ; pedicel smooth, about 1 centim. long. Tufts dense and radiculose, green and faintly glossy. Stem irregularly divided ; branches not compressed ; monoicous."

"Limestone rocks, Canada, Ottawa ; 1892, Macoun."

38. BRACHYTHECIUM FITZGERALDI (C. Muell.) Ren. & Card. Rev. Bryol. 20 : 17. 1893.

Hypnum (*Brachythecium*, *Cavernularia*) *Fitzgeraldi* C. Muell. Flora, 70 : 224. 1887.

"Dioicous ; tufts low, pulvinate, broad, yellow, loosely interwoven : stem with branches short, more or less parallel, slender, round-julaceous ; branchlets very short, rather spreading, single : stem leaves closely appressed, when moist scarcely spreading with cordate base semi-circularly impressed, rather broad ovate, short-acuminate ; more or less ventricose-concave on both sides of the narrow vanishing deeply canaliculate green costa ; margin nearly plane, everywhere slightly denticulate ; cells very narrow, long, pale yellow ; alar cells many, small, hexagonal ; fruit unknown."

Type locality, Florida. Collected by Fitzgerald. Specimens not seen.

No specimens of *B. Fitzgeraldi*, *B. cavernosum* or *B. calcareum* have been accessible and the original descriptions are quoted.

EXCLUDED SPECIES.

M. Cardot was the first to discover that *Brachythecium Donnellii* Aust. Bot. Gaz. 4: 162, is not a *Brachythecium* at all, but a *Stereophyllum*, closely related to *Stereophyllum leucostegium* (Brid.) from Mexico and the Antilles.

Professor Warming also communicated specimens of the Greenland plant referred to *Brachythecium trachypodium* (Funck) Br. & Sch. (*Fl. Gr. p. 336*). They are sterile and I can see no reason why they should be referred to *B. trachypodium* rather than to the closely related *B. velutinum*.

Specimens of Ren. & Card. Musc. Am. Sept. Exs. 108. (*B. latifolium* Lindb. Philib.), seem to me to be nothing but slender forms of *B. rivulare*. The stem leaves have the characteristic short acumination of that species. The plants do not agree either with Limpricht's description of *B. latifolium*, or with European specimens of that species determined by Brotherus and kindly communicated by M. J. Cardot.

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